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MANHATTAN MUNICIPAL PLANT.

Note has already been made in these pages of the report of Dr. Cary T. Hutchinson on the cost of furnishing and operating a municipal electric light plant for the Borough of Manhattan. This report is a sequel of the agitation last winter for a municipal plant, started by Commissioner Munroe, and may possibly be used as a basis of expenditure later on by the city. In this report Dr. Hutchinson has put the cost of one arc light, including interest, at 3½ per cent., and depreciation at 8 per cent., at $69.40 for 10,000 lights, and $80.80 for 5,000; with an obvious or apparent saving over present prices of several hundred thousand dollars annually. Of Dr. Hutchinson's expert ability and fairness there is no question, but his report has one or two curious features, and we doubt very seriously whether central station men will accept his data of maintenance and operation.

We note, for example, that "in the estimate of the cost of the central station, no charge is made for real estate," because the city has some available. But is that true finance and sound political economy? Whether the city owns it or does not, the use of the real estate involved just represents the employment of so much capital which comes in the end out of the taxpayers' pockets; and there is no dodging the item by mere omission. The proposed plant cannot be installed on a floating cloud; and every inch of real estate it occupies means an addition to the estimates, not less for the generating system than for the sub-stations. So, too, with regard to the subway ducts, an item of cost that is omitted by the instruction of the city authorities, because of their assumption that they can use all the ducts they want free of rental. Now that is a cool proposition we should very much like to see tried out. When we recall the severe cost of the subways to the private companies using them, we should note with much interest any endeavor of the municipal plant management to use even a single duct free of any cost and expense whatsoever. This is a fond and foolish superstition put forward from time to time with grave naiveté. Our modest opinion is that it will not stand the light of day for ten minutes. Then again, no allowance is made for "lost taxes," the reason being that "as a matter of fact, the taxation of the existing companies would not be affected in any way by the operation of this plant." Well, now, a contrary argument to that strikes us as strongly tenable.

Coming to costs, operation, etc., we note that Dr. Hutchinson is going to get some right smart work done in cheapening things. The cost of generating and distributing the current right up to the lamps, is to be only 1.27 cents per kw-hour. We have no such figures in our possession for a large network, and we question whether any central station manager has, either. Certainly, no such figures go in New York, with its extraordinary cost of every kind, letting alone duct hire. Then as to maintenance, $5 a year per lamp is enough for "the cost of inspection, trimming, carboning, globe breakage and repairs of arc lamps, and of renewals, metering, etc." We would greatly like to know where such estimates or actuality came from, and we venture to challenge the figure flatly, for if the data we are familiar with has any validity at all, $12-$15 would be nearer the mark. In the same manner doubts of a serious character might be put forward as to the figures for the incandescent service; but at this juncture we desire only to say that half-a-dozen reports of this kind,

however estimable their authors, would not warrant the city in taking on further municipal business investments.

Even as the report stands, it reduces to absurdity the figures that Commissioner Munroe cited as to alleged cost in other parts of the country, and shows that some persons who assume that arc lighting can be done for some of the rates then quoted are either cheating themselves or fooling other people. Back of all lies the danger of any further investment by New York in business enterprises, not one of those it now owns being administered on proper and profitable lines.

On Electrical Larceny.

The report of the Committee on Theft of Current, at the recent National Electric Light convention, was a grim, almost facetious comment on the frailty of human nature. The acute desire to get something for nothing which we regret to say is one of the mainsprings of original sin, does not always stop on the hither side of honesty; and the report of its incursions into the field of petit larceny is almost amusing. It would be interesting to know the actual extent to which stealing current has been carried, but the appointment of a committee on the subject indicates that the aggregate amount at least is a subject of some importance. We hope that the explanation of the various devices for beating the company will not be given too wide publicity, for a too general dissemination of the preferred methods would constitute a sort of current thief's *vade mecum*. Fortunately, most seekers after free current are not skilled electricians and generally do but a bungling job—in fact, we have heard of magnets and chunks of iron being placed where they would accelerate the meter and hoist the well-meaning but misguided trespasser with his own petard. We commend to the W. C. T. U and kindred organizations the statement that saloons seem to be specially addicted to a longing for free current, but are somewhat shocked to learn that large and supposedly reputable customers have shared in the spoliation. However, no very considerable amount of current can be long abstracted without detection by a careful manager, and a very few detections and punishments of so petty and sneaking an appropriation of other people's goods will serve to scare away similar sinners. As to remedies, constant vigilance seems to be the most effective, and systematic metering on the various feeders will generally give a clue to any material losses. Installation of meters and switches in easily viewed positions would seem to us one of the best preventive measures. Snarls of wires in dark corners are bad in themselves and give peculiarly good opportunities for dodging the meter.

The Enclosed Arc.

It is a pleasure to read so clear and judicious a discussion of an electrical topic as Prof. Thomson's convention paper on the enclosed arc. No man knows better the history of arc lighting, or the minute technical details of his subject. Especially valuable is his dispassionate and accurate estimate of the limitations of the enclosed arc, theoretical and practical. The commercial phase of the subject speaks for itself. During the last half dozen years, the enclosed arc has gradually crowded out its predecessor, until at the present time one would almost be justified in saying that no station uses open arcs as a deliberate matter of preference. It may retain them temporarily, but as a rule discards them as soon as it can "raise the wind" to replace them. In the early days of enclosed arc lighting, all kinds of troubles were encountered—inner globes grew smoky, or melted from the excessive heat; unskillful trimming produced sticking of the carbons or left leaks which resulted in the rapid consumption of the carbons; and divers other troubles were encountered. These have gradually been eliminated by experience, so that they are now of small moment. But as Prof. Thomson points out, the quality of the carbons is the fundamental thing in working enclosed arcs, and we may add that this is particularly true of alternating enclosed arcs. Very homogeneous and pure carbons of just the right degree of hardness and of very exact dimensions are the prime necessity; and as enclosed arcs have become more common, the carbon manufacturers have risen to the occasion. And with carbons of this class came the success of the improved carbon feed, which has reduced the arc lamp to practicable dimensions for general use. Perhaps the greatest value of the enclosed arc lies in the field thus widened. Its great steadiness and brilliancy has pushed it into indoor illumination to an astonishing extent, and while its color and efficiency are not all that could be wished, its convenience lessens the gravity of these limitations.

Electrical Salt Works.

It will be new to most of our readers we fancy to learn that a dozen or more electric plants situated in the salt belts are actually making use of their exhaust steam in working salt evaporators. Mr. Dow's N. E. L. A. paper gave something of the relations of the process, but we wish that he had gone into some detail as to the real financial results. In some respects salt evaporation is a particularly good way to use waste steam, for there is no peak to that sort of load, and the use of steam can be the better adjusted to meet the conditions of economy. We wish some engineer without a bias for or against the extra territorial use of steam would make an exhaustive study of the working conditions in electric light plants to see to just what extent the sale or utilization of exhaust steam is really more profitable than employing it in the condensers and feedwater heaters. We have seen plants which obviously made money on this by-product and others which have apparently lost, and between these two extremes lies a debatable ground which has been very imperfectly explored. Not many plants are fortunate enough to have available salt supply for working up in the manner described by Mr. Dow, but we should say that those thus situated could utilize the exhaust with exceptional chance of profit. Hence, all the more we wish that the actual results reached in the process could have been put on record; we hope that at some future convention the topic, in the larger aspects as well, will be made the subject of a full discussion. Any means of increasing the final dollar-and-cent economy at small stations will certainly be welcome.

The Field Surrounding a Crookes Tube.

In the last number of the *Proceedings* of the American Philosophical Society (No. 172, Vol XLII, January, 1903, page 96), is a paper by Prof. A. W. Goodspeed on some peculiar effects of secondary Röntgen radio-activity. He noticed that when a sensitive photographic plate was supported upon an iron tripod with a ring top, and an active x-ray tube was supported above both, the sciagraph of an object, such as a circular piece of bronze, laid upon the upper surface of the plate, seemed to be affected by the presence of the iron tripod ring on the under surface. The sciagraph, as developed, was less dense just over the tripod ring.

A number of interesting experiments are detailed with excellent sciagraphic illustrations, only, unfortunately, these sciagraphs are reversed by printing and appear as positives, instead of being reproduced by reprinting, in the original negative condition; so that the results are not easy to interpret. The effect seems to be due to scattering and irregular reflection of the x-rays. Thus, it has been known that a fluorescent screen will show a feeble glow, and x-ray activity, behind a large thick steel plate, when an active Crookes tube is held in front of the plate. It is known that x-rays cannot be reflected in the optical sense by a plane surface. There is no x-ray mirror; but x-rays will scatter and fly out in all directions from such a surface, so that when they strike an opaque or semi-

opaque substance, the surface of that substance will act as a secondary and relatively feeble source of x-rays. Consequently, when a developed plate is blackened by exposure to x-rays, most of the blackening is due to frontal attack, but some comes from x-rays that have performed a flank movement by scattering and recoil, from more distant bodies, to the back of the plate. An opaque screen at the back of the plate cuts off the flanking movement. If this theory is correct, it would seem that the most accurate sciagraphy requires a leaden back plate for the sensitive plate so as to eliminate all but the frontal attack and direct beam.

LOOKING A GIFT HORSE IN THE MOUTH.

Mankind values things somewhat in proportion to the difficulty of obtaining them, and perhaps this mental obliquity may account for the hypercritical attitude of people at large toward those things which have lost the charm of novelty. We were greatly impressed in reading Mr. Cooper's convention paper on variable speed control, with the singularly perverse attitude of the layman toward electric motive power as displayed in the requirements noted in the study in question. Mr. Cooper has set them forth as they confront the engineer, and they are strenuous, indeed. Just because the electric motor can be given a very wide range of speed things are demanded of it as a matter of course, which no one would ever dream of demanding of other motive power, and there is a strong disinclination to pay for the piper. A man who fifteen years ago had requested a lathe fitted to vary three hundred per cent. in speed by steps of one per cent. would have been bidden hence to the place of sinful departed souls, but now he brazenly stands up and demands it, and expects to get it at the same price he would pay for an extra set of back gearing. His old engine of the slide valve persuasion would vary five per cent. in speed fifty times a day, but when he puts in a motor he specifies that the speed shall not vary more than two per cent. from no load to fifty per cent. overload. Now these refinements cost money, often quite out of proportion to their real importance, and the burden of this note is to suggest a certain attitude of mental perspective on the part of the public. If purchasers would lay stress only on those qualities which are of practical importance in their particular case, the whole electrical business would be simplified. Drop long-winded specifications and get down to hard pan, and the way will become easy and relatively cheap.

A. S. M. E. AND THE METRIC SYSTEM.

The report of the committee of the American Society of Mechanical Engineers appointed to discuss the arguments in favor of and against the metric systems, has just been published. It is a heavy paper. It weighs 127 grammes, occupies 82 pages of printed matter, and 150 c.c. of volume, besides forming part of Volume XXIV of the *Transactions*. It is a most interesting document and presents its interest in a variety of directions. Four members were appointed on the committee, two metric and two antimetric. They have evidently performed their task fairly and in good faith. With excellent judgment they all four signed a joint report covering such articles as they could all unite upon and then proceeded to draw up their respective metric and anti-metric briefs in parallel columns. The metric brief is much the briefer of the two, occupying 197 lines of text; whereas the anti-metric argument occupies 513. Clearly the laboring oar is the one on that side of the boat which tries to defend the existing disorder of things. Nothing more clearly indicates than this the steady progress of the country towards the international metric system. Only about twenty years ago, the mechanical engineers and mechanics of this country would not even have deigned to consider the question of the national adoption of the metric system. Now they not only consider, but they move earth and heaven to procrastinate the inevitable doom of the unfittest which in the natural course of civilization ever goeth to the wall.

The joint report of both sides is a very sensible page. Its gist is that Congress should not, would not, and could not, legislate as to the particular kind of weights and measures that a citizen may elect to use. This sentiment we endorse heartily. If a man prefers to sell his land by the toise, vara, cubit or Flemish ell, he should not be penalized or legally oppressed. Moreover, every effort should be made to spare the expense and annoyance of change in standards such as must fall more particularly upon the mechanical industries. The trouble can be minimized by intelligent co-operation, and the expense of any section of the community can only be justified by the gain of the commonwealth at large. It is wonderful that some mechanics and engineers can be so oblivious of these defects in our ancient medley of measures which the European perceives so glaringly. We have in this country no less than three ounces, a hideous trinity, to wit: the troy ounce, the avoirdupois ounce, and the fluid ounce. They are all in extensive use, and no man may know what an ounce is, save by context or qualification. To add to the absurdity, there is an appreciable difference between the British and the American fluid ounces. There are two different pounds—the avoirdupois and the troy. There are two different tons, the long and the short. There are three kinds of drams, two kinds of hundredweights, three kinds of gallons, three kinds of quarts, three kinds of pints; besides various other incongruities and ambiguities in units less frequently, but not less actually, employed. Against this absurd jumble that a hottentot would despise, there are the metre, the litre, and the gramme, which are one and the same all over the world. The metre, the litre and the gramme are interconnected throughout all their multiples or subdivisions by decimal ratios like those between the dollar, dime, cent and mill. The 64 units in actual use entering into our grand old jumble are interconnected by ratios and cross-ratios so quaintly complex, and so incongruously inexpedient, that no man can remember them. It is like reading "Alice in Wonderland" to review them. It is cruelty to teach this medley to children, stulification to study it among adults, shame to perpetuate it for the race. And this is the labor-creating barbarism that some of our mechanics would maintain at all hazards, despite the fact that to mechanics as a body we owe all our labor-saving devices.

In the days of old Rome, all numerical values, and therefore all quantities, such as sesterces, talents, sheep or oxen, were written down in Roman numerals. The addition or multiplication of quantities thus symbolized was a task of relatively tremendous magnitude. Even the professional clerks, trained to the yoke, had to employ the abacus to help them. The labor wasted in the Roman system by the community aggregated a heavy tax. The Arabic system of numerals, which is now international, came to the Roman empire from the east. It offered enormous saving of labor, and rendered all weighings, measurements, records and bookkeeping much easier. Every man could reckon for himself. But the Arabic system was only introduced after a long and protracted struggle against the fanaticism of the "sweating calculators" who opposed the innovation by every means in their power. In England at this date there appear to be very many intelligent men who oppose the introduction of a decimal currency such as ours, and advocate the retention of their ridiculously cumbersome and labor-creating system of pounds, guineas, shillings, florins, crowns, half-crowns, sixpences, threepenny bits, pence, half-pence and farthings. The arguments they offer bear a gruesome likeness to those which are offered by the anti-metric system conservatives in this country.

International Electrical Congress at St. Louis.

The following is the Committee of Organization of the International Congress of Electricity to be held at the St. Louis Exposition in 1904:

President—Elihu Thomson. Vice-presidents—Prof. H. S. Carhart, C. F. Scott, Prof. W. E. Goldsborough, Dr. W. S. Stratton. General Secretary—Dr. A. E. Kennelly. Treasurer—W. D. Weaver. Advisory Committee—B. J. Arnold, B. A. Behrend, C. S. Bradley, J. J. Carty, A. H. Cowles, Prof. F. B. Crocker, Dr. L. Duncan, H. L. Doherty, Prof. R. A. Fessenden, W. J. Hammer, C. Hering, L. B. Stillwell, C. P. Mathews, R. D. Mershon, K. B. Miller, Dr. W. J. Morton, Dr. E. L. Nichols, Prof. R. B. Owens, Dr. F. A. C. Perrine, Prof. M. I. Pupin, Prof. J. W. Richards, Prof. H. J. Ryan, William Stanley, Prof. C. P. Steinmetz, A. J. Wurts.

The duties of the organizing committee will be to prepare a programme for the International Congress of Electricity, to name the participants therein, to secure the ways and means for the conduct of the Congress, and to promote general interest in the congress.

The Exposition has set aside the week beginning Monday, September 12, 1904, for the meeting of this congress, and will at that time place at its disposal halls sufficient in number to accommodate the general sessions and department meetings. The committee will be subject to the call of the president and secretary.

Telephony and Wireless Telegraphy in England.

In the British House of Commons on June 8, Mr. Austen Chamberlain, the Postmaster-General, explained his attitude toward Marconi's enterprise in Great Britain, which has been condemned in some quarters as checking progress in wireless telegraphy. Mr. Chamberlain said he did not desire to hamper a new invention, but the post office did not intend to throw away its right of monopoly in public communications as it had done in the early days of the telephone. He had not been dealing with Mr. Marconi, but with the company owning Marconi's invention. The company asked for a permanent exclusive right to use ethergraphy in Great Britain. This was refused, on the ground that the request was not business-like. When the company was prepared to talk business he was prepared to deal with it. The company asked the post office to act as its agent in the collection of messages in Great Britain for transatlantic Marconigraphing.

Mr. Chamberlain submitted certain conditions with the view to preventing interference with the Admiralty and also for strategic reasons, adding that when the conditions were accepted and the company satisfied the post office's experts of its ability to send messages across the Atlantic the post office would appoint the company its agent, as it already has done in the case of the cable companies. That letter was sent to the company on March 31, but no reply had been received. Mr. Chamberlain contended that the post office was in no way to be blamed for the delay, but it refused to take the public's money for messages until the company was willing to allow the post office experts to go to Poldhu and satisfy themselves that the wireless system is workable.

Referring to the National Telephone Company, whose conduct of business, he said, had long been a source of public anger, Mr. Chamberlain said he rejoiced that its license would expire in 1911. He declared that never again would the monopoly in telephones pass out of the hands of the post office.

Electricity at the Berlin Chemical Congress.

According to cable advices from Berlin of June 7, as to the meetings of the Chemical Congress at Berlin, Prof. W. Markwald, of Berlin, showed the electrochemical and physical section a smudge of dark powder on a piece of paper, which was the first time that any of those eminent scientists had seen the metal polonium, discovered by Prof. and Mme. Curie, of Paris. The latter doubted whether polonium was a primary element or related to bismuth, but Prof. Markwald demonstrated that it was, indeed, a primary element. He exhibited a bit of the metal, weighing 15-100 of a grain, which was produced from two tons of uranium at a cost of $75. It is more thinly distributed in uranium than xenon, the most rarefied gas, is in the atmosphere.

Prof. Markwald proceeded to give an exhibition of the powers of his speck of polonium. It intercepted a strong current of electricity passing through the air from the generator to the receiver, the air ceasing to be a conductor for the flashes. The room was then darkened and pieces of barium, platinum and zinc blende, placed near the polonium, glowed with a bright greenish light.

In the section of organic preparations, Prof. Proskauer, of Berlin, read a paper on the sterilization of drinking water with ozone and on ozone waterworks, the German electricians having succeeded in cheaply producing a concentrated solution of ozone. The speaker, with Profs. Ohlmüller and Prall, of the Imperial Health Office, made exhaustive experiments with the solution in purifying water. The experiments included tests with water artificially impregnated with the deadliest disease germs, like typhus, cholera and dysentery. Such water was pumped through the so-called "ozonizing tower" and then rigidly analyzed. All the germs were found to be killed, whereas the ordinary method of sand filters left the germs living. Moreover, the water was greatly improved in quality through the increase of oxygen from the ozone. Prof. Proskauer said the ozonizing plant was cheaper than the sand filtering system usually used in city waterworks, hence the time had come for the general introduction of ozone plants. The town of Wiesbaden, added the professor, already has one of these plants, which sterilizes two hundred and fifty cubic meters of water hourly.

Crookes on Atomic Fog.

Prof. Sir William Crookes, before the International Chemical Congress in Berlin last week, dealt with the possibility of reducing all the elements of matter to one, and ultimately finding this resolvable into a single form of energy. The subject was "Modern Views on Matter—the Realization of a Dream." Sir William cited the utterances of Sir Humphrey Davy and Faraday as anticipating the possibility of reducing the elements to simpler bases, spoke of the significance of the Röntgen rays and Becquerel rays, and the experiments of Curie and others, and said:

"All these observations find internal connection in the discovery of radium, which is probably the basis of the coarser chemical element. Probably masses of molecules dissolve themselves into the ether waves of the universe, or into electrical energy. Thus we stand on the border line where matter and force pass into each other. In this borderland lie the greatest scientific problems of the future. Here lie the final realities, wide reaching and marvelous.

"The nineteenth century saw the birth of new views regarding the nature of atoms, electricity and ether. While our views about the composition of matter are generally satisfactory to-day, will that be the case at the end of the twentieth century? Do we not again see that our investigations have only a temporary value? Will we be content to see matter dissolving into a multitude of revolving electrodes? Such a mysterious dissolution of atoms appears to be universal. It occurs when a piece of glass is rubbed with silk. It is present in sunshine, in a raindrop, in lightning, in a flame, in a waterfall, and in the roaring sea. Although the whole range of human experience is too short to form a parallax whereby we can foretell the disappearance of matter, nevertheless it is possible that formless nebulæ will again prevail when the hour glass of eternity has run out."

Notice Serving by Wireless Telegraphy,

Mr. Hearst, proprietor of the *New York Journal,* was served with notice by wireless telegraphy, in a suit concerning death and damage caused by election fireworks. Mr. Hearst was on the *Kaiser Wilhelm II.,* bound for Europe. It was easy to send a cable message, but not so easy to get proof of its delivery. Accordingly this message to Mr. Hearst was sent across, to be transmitted by the Marconi system to the steamship as she neared Plymouth: "City of New York has been sued for $25,000 in New York County Supreme Court by Solomon Landau for damages for death of George Landau by your fireworks explosion on election night, November 4 last, and notifies you to defend this action." When the *Kaiser* got here on the return voyage, it was learned by the Corporation Counsel that George Kroncke, the operator aboard, had received the message from the coast of Ireland while the ship was a day out and that the message had been delivered to Mr. Hearst in his stateroom at 2 o'clock in the morning. Kroncke made an affidavit to this effect.

Rebuilding the Duluth General Electric Company's Station.

By CLIFFORD L. HIGGINS.

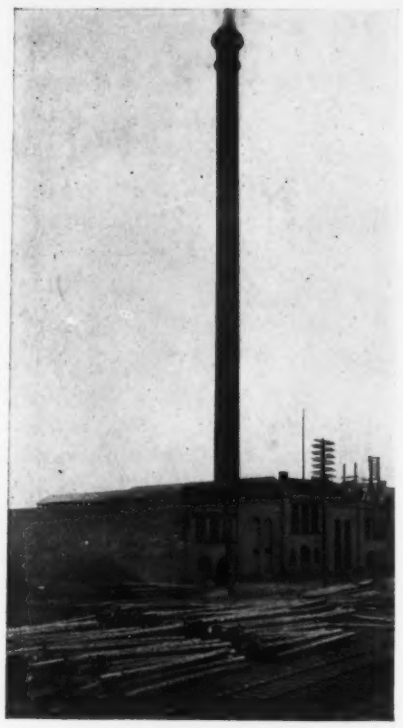


FIG. 1.—EXTERIOR VIEW OF STATION.

IT is a well-known fact that as the population of a city increases old methods, appliances and machinery become obsolete, and the demand for electric light keeps pace with such growth. Thus sooner or later the entire electric plant has to be either built anew, added to or remodeled. The latter method was chosen by the Duluth General Electric Company during the winter of 1901-2. At that time the steam plant consisted of one 400-hp Scotch marine boiler, three upright Butman boilers and five horizontal Butmans. This steam plant having been enlarged shortly previous to this, needed no changes, as it was of ample capacity for the proposed increased load. In the engine room there were two 650-hp Allis cross-compound engines, one 400-hp single-cylinder condensing Hamilton Corliss, and one 150-hp Hamilton high-pressure, single-cylinder engine. One of the first two engines mentioned was belted to a line shaft in the basement beneath the dynamo floor. From this were driven one 120-kw, 1,100-volt alternator, one 120-kw, 2,200-volt alternator, one 75-kw, 550-volt direct-current generator, seven 50-light Thomson-Houston arc machines and one 30-light Excelsior arc dynamo. The line shaft of the second large engine was run by a rope drive, and attached to this shaft were two 120-kw, 1,100-volt alternators, one 60-kw, 2,200-volt alternator, one 250-kw, 550-volt, direct-current generator and three 50-light Excelsior arc machines of 9.6 amp. The 400-hp Hamilton engine drove three 120-kw, 1,100-volt alternators, and one 35-kw, 1,100-volt alternator. Attached to the small engine were one 120-kw, 1,100-volt alternator and one 35-kw machine of the same style. All of the above alternators and the 250-kw, direct-current generator were of the General Electric make.

Thus it will be seen that, as in so many of the older heterogeneous plants, there were in all about thirty-six machines, including the exciters. To control the output of the alternators, there was a marble skeleton switchboard having 14 panels, one to each circuit, by means of which board any circuit or combination of circuits could be carried as a load on any of the machines. The arc current was handled and distributed by a wooden plug and socket board, which adjoined the alternator board. This arc board was provided with amperemeter, voltmeter and ammeter jacks and from it were run 16 circuits. But the plant became far overloaded and as the equipment was nearly worn out, it was decided to remodel it to conform as nearly as possible to the best modern practice.

The distributing system was entirely rebuilt during the summer of 1901, and the various districts are now fed by banked transformers operating on a 208-volt, three-wire secondary system. During the entire time that the changes were being made, it was necessary to carry nearly the full load on the old machines; and the problems met with in doing this can be better imagined than described. The floor of the old dynamo room had to be lowered six feet to the level of the engine room floor, but of course this was accomplished a little at a time, as one unit after another was placed on the new foundations, and it was possible to shut down the old machines, which were operating on the floor above. Much of the work was done on Sundays and at night, when the load was somewhat lighter. The first of the new three-phase alternators was unloaded from the cars, was placed on its foundation, and was supplying current inside of forty-eight hours, between October 14 and 16, 1901. This machine was a 500-kw, 4,000-volt, 60-cycle generator, and was belted on to the first of the large engines mentioned above.

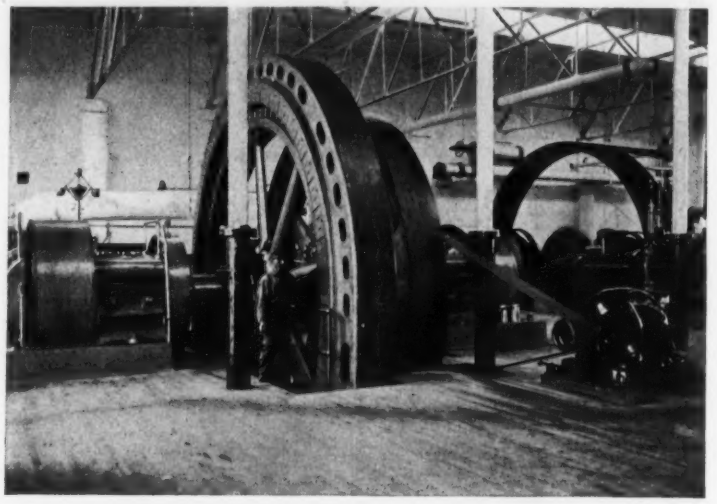


FIG. 3.—1,500-HP ENGINE AND 1,050-KW GENERATOR.

On one end of this generator shaft a pulley was placed which drives the old 75-kw, 550-volt, direct-current generator, which served to care for overloads and emergency cases on the direct-current service. Bolted to the opposite end of this machine also there is an exciter whose armature is mounted directly on the generator's shaft. On December 15, the same year, the second large alternator was connected up by the rope drive to the other large Allis engine. At the same time, the new three-phase board was placed in position, the first new machine having been operated from a temporary board

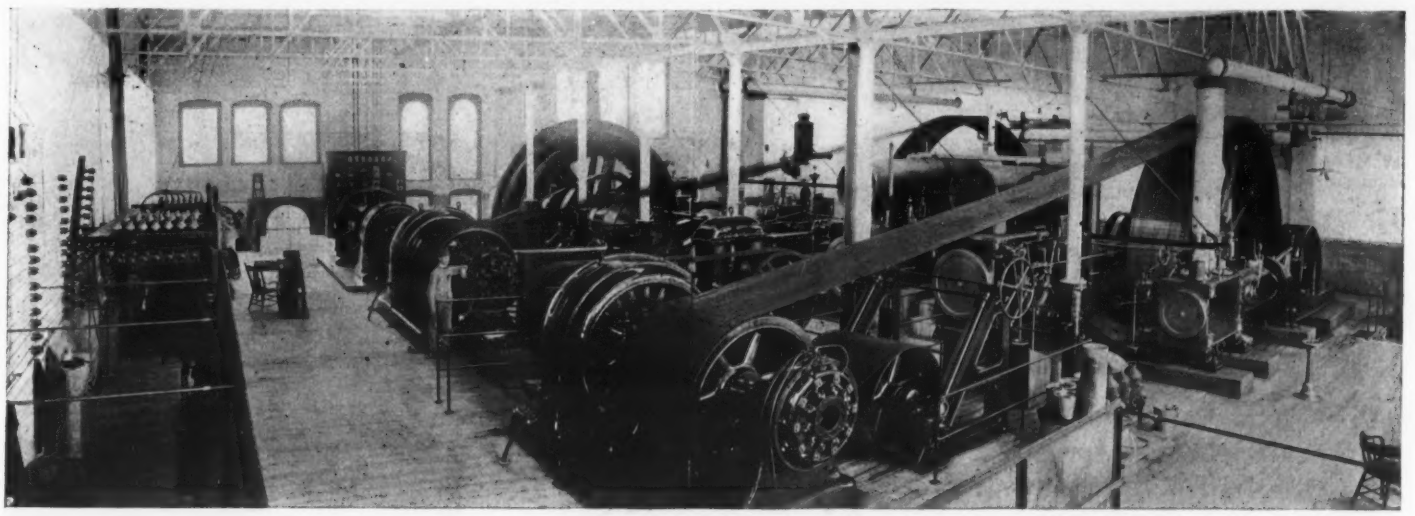


FIG. 2.—GENERAL VIEW OF COMPLETED STATION, DULUTH.

until then. Even with the new big machines and what remained of the smaller ones, it was just barely possible to carry the heavy load at Christmas time.

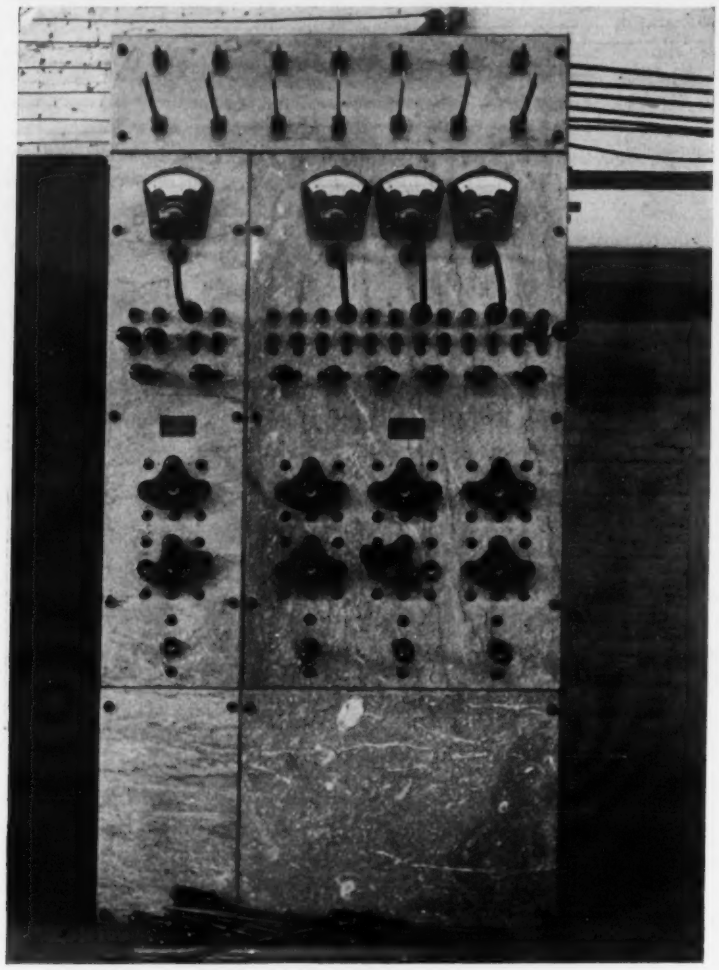


FIG. 4.—ARC SWITCHBOARD.

During the summer of 1902 the two small engines and foundations were removed and the concrete foundation was built for a 1,500-hp cross-compound Allis-Corliss engine 26 x 52 x 48 in., 100 r.p.m., which is direct-connected to a revolving field, 1,050-kw, three-phase, 60-cycle generator. The fly-wheel of this engine weighs 56 tons, the fields also being very heavy. From this fly-wheel is belted a 35-kw, 125-volt, direct-current exciter. On account of the station standing over what was formerly swamp land, the vibrations of the ground caused by the big engine were felt in some tall wholesale houses nearly a block distant; but this trouble was soon overcome.

Turning our attention now to the switchboard, we find that it is of fine gray Vermont marble, and from it all the generators and circuits are handled except the arcs. The system used is three-phase, four-wire, with a grounded neutral. The board originally built consisted of two generator panels, one synchronous motor panel, and three feeder panels, all supplied by the Stanley Electric Company. The feeder and motor panels are fitted with combined circuit-breakers, and switch and plug and cable connections. There are nine feeder circuits leaving the station. The last panel at the left is the one installed by the General Electric Company, and is used to control the output of the 1,050-kw generator. Near the center of the board is the panel to control the 4,000-volt, three-phase, 300-kw General Electric synchronous motor, which is connected by an insulated coupling to the old 250-kw, 500-volt, direct-current generator. The compensator for this motor sets out in front of the switchboard, but separate entirely from it. Besides the usual voltmeter and lamps, there is a Lincoln synchronizer on a swinging arm at the end of the board for use while placing the alternators in parallel.

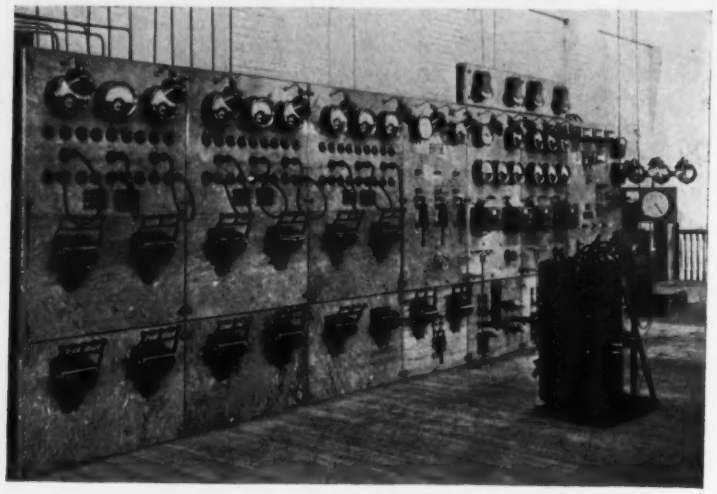


FIG. 6.—GENERATOR AND FEEDER SWITCHBOARD.

Standing in line with the main board, but away from it about 6 feet, is the arc board. The General Electric enclosed series constant-current system is used entirely for street lighting. This board has on it the usual plug switches, ammeters and knife switches to cut it off from the main board. There are seven of the arc circuits on which are operated 360 6.6-amp. enclosed arc lamps. In a well-lighted basement beneath the board are placed the four constant-current General Electric transformers.

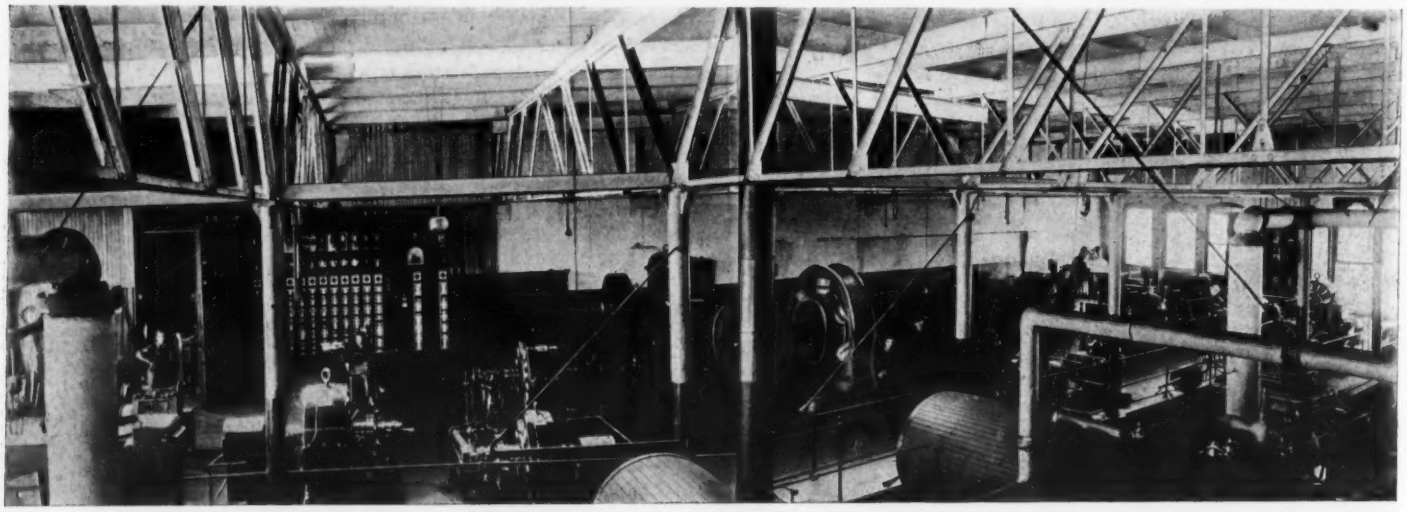


FIG. 5.—GENERAL VIEW OF STATION BEFORE TEMPORARY WIRING WAS PUT IN.

At the present time the company are still furnishing the 550-volt, direct-current to their customers through the old wooden switchboard, but this will soon be discarded for a new marble one to correspond with the rest of the equipment.

The remodeling of this plant was done under the supervision of Sargent & Lundy, of Chicago, who were directly represented on

the work by Mr. B. J. Jones. The General Electric Company furnished all the new machines, and also all the transformers, both for the arc service and the entire line service. The work is interesting in many ways, and is doubtless typical of much that remains to be done in other large systems of early design and construction, in which the increase of the business and the growing demands for current necessitate radical changes to meet the newer conditions in the industry.

The new engines, as well as the old ones, were given a severe test during February of this year. Peculiar atmospheric conditions existed which caused an abnormal amount of static current on the lines. This static caused a fuse to blow on the arc board, which started a blaze that short-circuited the main bus-bars, into which were feeding a 500-kw and a 1,050-kw generator. It was seen in an instant that nothing would stop the blaze except the shutting-off of all current, so the load was pulled off both engines without warning. Neither ran above speed; and the blaze going out, the generators were paralleled again, and service was resumed in less than a minute. Needless to say, the fuses were then moved to the basement and enclosed in separate brick compartments.

Lifting Electromagnets.

BY D. A. WILLEY.

IN several large industrial plants in the West the electromagnet is being put to a comparatively new use in lifting and transferring loads of various sizes. The familiar hook and block is replaced by a mass of metal, varying in size according to the service required. It is connected with the generator by wiring, the magnet usually being constructed with one coil and one center pole, while the two outside poles with the plate connect the three together. The ends of the coil through which the current passes come through the top of the plate and are connected across the line. However, the magnets are sometimes made with several poles and coils varying from two to a dozen or more. In this case the coils are usually connected in series.

The remainder of the mechanism is similar to the crane usually installed in ordinary shop practice, but at the elbow of the motorman is a special switch for controlling the electromagnet, which is, of course, separate from that which is utilized for lighting and transferring. If a slab of steel or a plate of iron is to be handled it is

FIG. 1.—REPILING LONG PLATES—LIFTING FOUR AT ONE TIME.

only necessary to run the crane to a point above it and lower the chain or cable with its magnet attached. The current is, of course, turned off from the latter as it is not needed when "light." When the magnet has been lowered sufficiently to come in contact with the surface of the slab or plate, by a push of his lever or perhaps the mere pressure of a button, it is energized by the application of the current and holds the load until it is raised, carried to its other position when the current is turned off and the magnet again becomes "dead," instantly releasing it from the other weight.

The advantages of this system are obvious. In service the time and labor required in fastening loads to the block of the ordinary crane—an operation often lengthy, as the load may have to be carefully bound with chains or cables and the services of perhaps a dozen men required, to prevent the load from slipping. After the magnet has a grip upon the iron or steel it can be handled with perhaps the aid of but one man besides the motorman merely to guide it into position. Here again the services of the hands are dispensed with since with the electric current turned off, the load is automatically released.

Bars of iron and steel, plates of different sizes as well as slabs can be transferred to and from railway cars and vessels, carried from

FIG. 2.—TRANSFERRING PIG IRON IN A RAILROAD YARD.

the stock yard to the furnace, shears, drill or other machine by this system as readily as by the ordinary electric or steam crane, and it is calculated that the time and labor saved represent nearly 50 per cent. in the cost of handling. A magnet of sufficient power will pick up not only one but three or four plates, if desired, transferring the lot as readily as one piece. It can be used in repiling merely by applying it to the edges of the sheets or plates, which can be again deposited in such regular order that the services of one man are merely required to "even up" the heaps.

As yet the electromagnet service, as it might be called, has been confined to handling comparatively light loads, but its capacity is only limited by the size of the magnet and the current provided. A

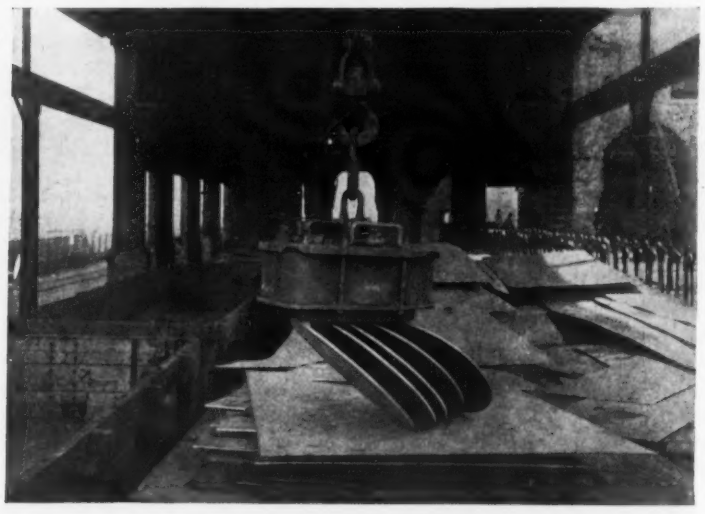


FIG. 3.—RAISING STEEL PLATES BY CONTACT MERELY WITH THE EDGES.

magnet weighing 350 pounds will easily pick up and transfer any distance a load weighing five tons, while the power required is about 3 amp. at 220 volts. If two or more magnets are connected with the same crane, of course the load can be increased accordingly by supplying each magnet with its own current. This merely means a little extra wiring. Among the plants where the service has been used with satisfactory results are the works of the Illinois Steel Company at South Chicago, the works of the Ohio Steel Company at Cleveland; while it has been adopted by a number of railroad companies for use in yards at Cleveland and elsewhere.

Telephone Exchanges—III.

By Arthur V. Abbott, C. E.

THE MAGNETIC SYSTEM OF THE RECEIVER.

THE earliest models of the receiver employed an electromagnet to create the field in which the diaphragm should swing, but this complication was almost immediately perceived to be unnecessary, and the simpler permanent magnet, amply sufficient for the purpose. It was at first considered desirable to secure the strongest possible magnetic field with which to surround the diaphragm, and receiver magnets were bent and contorted into all conceivable shapes, so that one leg of the magnet could be connected to and polarized the diaphragm, but with very disappointing results. With present familiarity with the theory of magnetism this failure is easily understood, but twenty years ago much less knowledge existed.

To view the magnetic system of a telephone receiver from the standpoint of the present conception of magnetism is to clear up many obscure points in receiver design, for we now believe that electricity and magnetism are so closely related that similar methods of reasoning apply to both, but as the units now employed in calculating magnetic mechanisms, and their use, is less familiar than the similar formulæ applied to electrical estimations, a brief *resumé* may be valuable to refresh the mind of the reader.

If the poles of a battery, dynamo or other electric generator be joined by a wire, something which we call "electricity" seems to traverse the conductor, apparently going away from the generator and returning thereto over the circuit. The amount of this something is found by experiment to be directly proportional to the power (e.m.f.) of the generator to push it along, and inversely proportional to the resistance of the circuit. This relation is stated by the famous Ohm's law to be $C = \frac{E}{R}$, in which C is the current in amperes, and E the e.m.f. in volts, which propels the current against the resistance, R, in ohms. Similarly when magnetism is under consideration there appears to be a something which traverses the bodies magnetized in a manner somewhat analogous to the electricity on the wire. To produce magnetism in any body a certain amount of force must be applied which may be termed *magnetomotive force,* as analogous to *electromotive force,* and the amount of magnetism produced will be directly proportional to the amount of magnetomotive force, and inversely proportional to the resistance of the body to be magnetized.

As a magnet seems to exercise more or less attraction or repulsion upon bodies or its neighborhood, it was natural to picture magnetism as something emitted, or projected from the poles of the magnet into space. Faraday gave the name of *"lines of force"* to this something, and conceived that these lines of force issued from the north pole of the magnet in the form of closed curves which swept through the surrounding material back to the south pole, in much the same fashion that electricity proceeds from the generator through the circuit and returns to its source.

We really know absolutely nothing as to the true nature of magnetism, but a very satisfactory working hypothesis is to imagine that this phenomenon is due to a stream, or flow in the ether. Suppose $A\,B$ (Fig. 12) to be a tube or pipe, with a centrifugal pump located in the middle at C, and conceive the entire apparatus to be submerged in a tank of water. If the pump, C, be operated, it will force the water along the tube toward B. As soon as the end of the confining walls of the tube is reached at B, the water current will fan out in all directions through the tank. Meanwhile to supply the place of the water forced out at B new supply must enter the tube at A. So presently a current is set up running through the tube in the direction $A\,B$, then spreading throughout the tank in all directions and returning by the end, A. Evidently the amount, or velocity, of the current will depend on the power of the pump, the resistance offered to the water flow by the friction of the walls of the tube, and the viscosity of the surrounding fluid. We may imagine that this is a rough analogy of the phenomenon of magnetism. The tube is the analogue of the ordinary bar magnet, the pump the magnetomotive force that sets up streams of ether that flow through the bar, issuing from the north pole, streaming through space to return by the south pole, and it is these streams of ether which we term a magnetic field. Now the amount of magnetism, or quantity of ether streams, will be proportional to the power of the pump (the magnetomotive force) and the resistance of the tube (the magnet) and that of the surrounding medium in which it is placed. In the case of the water pump the friction of the tube and fluid in the tank requires a constant expenditure of energy to maintain the current, but the ether is supposed to be *frictionless,* hence while an ether stream will always require the expenditure of energy to start it, or stop it, after it is once set in motion, it will continue to flow until forcibly arrested; herein lies the explanation of the constant exhibition of magnetism by a magnet after it has once been magnetized.

But all this, while a beautiful though somewhat fanciful theory, is too intangible for the engineer who wishes to express in definite units the entities with which he deals and calculates therewith.

In the c.g.s. system the unit of force is that amount of force which, acting for one second, will produce a velocity of 1 cm per second, in a mass of 1 gramme; this is called the *dyne;* measured in gravitation units, this force is approximately equivalent to the weight of a milligram. As a magnet exercises a force upon a body placed in its vicinity it was natural to assume as the unit magnet, such a magnet as would exercise a force of one *dyne* upon another exactly similar magnet 1 cm away from it. To project its force over this centimeter of space the magnet must display a certain amount of magnetomotive force, in order to overcome the resistance or *reluctance* as this opposition is usually called (in contradistinction to electrical resistance) of the air space, so the *reluctance* of a cubic centimeter of air is assumed as the unit of magnetic resistance. Theoretically the unit of reluctance is that of a cubic centimeter of an air pump vacuum, but to all intents and purposes, for practical

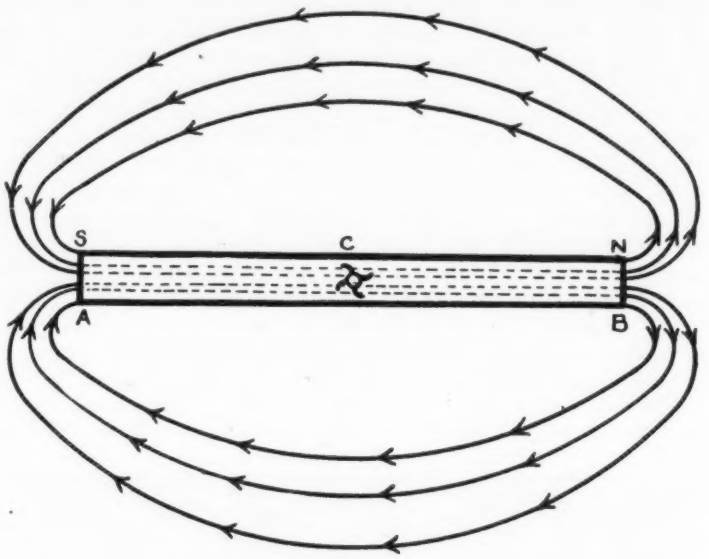


FIG. 12.—DIAGRAM OF HYPOTHETICAL MAGNETIC CIRCUIT.

work at least, the magnetic reluctance of a cubic centimeter of all non-magnetic materials (everything but iron, nickel and cobalt) is the same as that of an air pump vacuum. This unit of reluctance is called the *"oersted"* and is symbolized by the script letter, $\mathfrak{R}$. From what precedes the unit magnet will exercise a pull or a push of one unit of force at a distance of one unit of space; in other words, it delivers a unit of magnetism through a unit of reluctance. This unit of magnetic *flow,* or *flux,* or *stream,* as it is variously called, is termed the maxwell, and it is usually indicated by the Greek letter, Φ. Lastly, the unit of magnetomotive force is the *gilbert,* and from the foregoing is that amount of magnetomotive force needed to drive one maxwell through one oersted. The symbol for the gilbert is usually a script letter, $\mathfrak{F}$. The law of the magnetic circuit can now be stated in terms which are as similar and as simple as those which apply to the electric circuit.

$$\Phi = \frac{\mathfrak{F}}{\mathfrak{R}} \quad \text{or}$$

$$\textit{The flux} = \frac{\textit{The Magneto-motive-force}}{\textit{The Reluctance}}$$

For example, if a magnetomotive force of $\mathfrak{F} = 500$ gilberts be applied when the total reluctance, $\mathfrak{R} = 5$ oersteds, the total magnetic flux in maxwells, or number of lines of force, will be

$$\Phi = \frac{500}{5} = 100$$

We now know of but two sources from which a magnetomotive

force can be derived. The first, oldest, and in many respects the least valuable source is that peculiar property which seems to be inherent in the molecules of certain kinds of matter, such as the loadstone, iron, nickel and cobalt, by reason of which they not only become magnets themselves, but are capable of creating the same condition in other similar bodies, and of filling the space that surrounds them with magnetic flux. The second is by the use of an electric current, for it is found, by experiment, that the space surrounding every conductor traversed by a current is invested with the properties of the magnetic field, and that the intensity of this field is proportional to the current. Now, if the conductor be bent in the form of a ring there will, with any given current, be a certain flux, or definite number of maxwells inside this ring, and if the current be doubled the flux will be doubled. Evidently the same result can be attained by keeping the current constant and causing the wire to make two turns; hence the magnetomotive force of any coil of wire carrying a current will be proportional to the current, and the number of turns; or that is the same thing proportional to the product of the amperes and the turns as *ampere-turns.* It is found that one gilbert is equal to 1.257 ampere-turns, or one ampere-turn equals .795 gilberts, hence the magnetomotive force of any coil can at once be expressed in gilberts by multiplying the ampere-turns by 1.257.

For example, assume a ring of wood having a cross-section of 5 cm² and a circumference of 100 cm, and suppose the ring

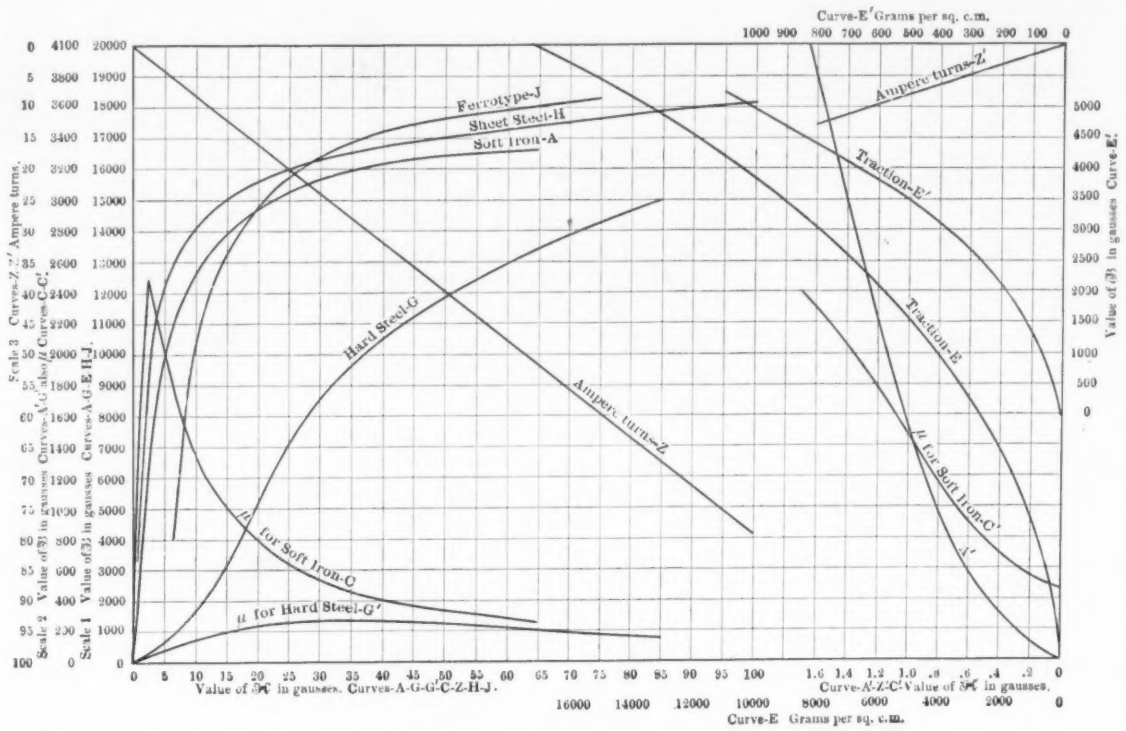


FIG. 13.—MAGNETIC CONSTANTS.

to be covered with 500 turns of wire through which 2 amp. flow. The magnetomotive force, $\mathfrak{F} = 500 \times 2 \times 1.257 =$ (number of turns $\times$ number of amperes $\times$ 1.257) = 1,257 gilberts. As the reluctance of wood is unity per cm³, the total reluctance of the ring is evidently directly proportional to its length, 100 cm, and inversely proportional to its area, 5 sq. cm, or $\mathfrak{R} = \frac{100}{5} = 20$ oersteds. The total magnetic flux in maxwells is $\Phi = \frac{1257}{20} = 62.85$. According to present ideas, this stream of magnetism circulates round and round inside of the coil, and as the area is 5 sq. cm the intensity or number of maxwells per sq. cm, or number of lines per sq. cm, is $\frac{62.85}{5} = 12.57$. In electrical measurements this corresponds to *amperes per square unit of area of the conductor,* a unit of measurement frequently used, but for which there is no individual name. In magnetism, however, there is a special unit for intensity of flux called the *gauss.* Its value is one maxwell per sq. cm, hence in the preceding example the intensity is 12.57 gausses. The total magnetomotive force, $\mathfrak{F}$ was found to be 1,257 gilberts, and as the ring is 100 cm around it the magnetomotive force per centimetre of length is $\frac{1,257}{100} = 12.57$ gilberts. The magnetomotive force per *unit* of *length* of a coil is usually symbolized by a script letter, $\mathfrak{H}$, and when the coil contains only non-magnetic material it is numerically equal, as shown above, to the flux density, and so $\mathfrak{H}$ = gilberts per linear centimetre in gausses.

The analogy so far traced between the electrical circuit and the magnetic circuit has been exceedingly close, but in two respects there are very grave differences. To the passage of both electricity and magnetism it is found by experiment that different substances offer very different amounts of opposition per unit of volume. Thus all of the metals are relatively very perfect electrical conductors when compared to the non-metals, although the poorest metallic conductors offer upwards of a hundred times the resistance of the best ones. In the case of electricity, the resistance per unit of volume is *constant,* no matter what amount of electricity may be driven through the conductor; thus any given wire will have exactly the same resistance whether it carries one-hundredth of an ampere or a hundred amperes. With magnetism, however, there are two striking peculiarities. In the first place there are only three substances, iron, nickel and cobalt, whose magnetic conductivity differs greatly from unity, and secondly the opposition which these three exceptions offer to magnetic flux is *not constant* as in the case of electricity, but varies with the *amount of magnetic flux* that happens to be passing. The result of this is to greatly add to the difficulty of making magnetic calculations, particularly as it is impractical to express this change in reluctance, in a simple form, and the only satisfactory way yet devised is to test experimentally samples of various substances and plot as a curve the relation between the magnetomotive force and the resulting flux. Fortunately only the various forms of iron are used to any extent in electromagnetic mechanisms, otherwise the labor of investigating, plotting and using a multitude of curves would have been overwhelming.

So far as telephone receivers are concerned, soft iron and hard steel are the only magnetic materials of which cognizance need to be taken. Fig. 13 gives a set of magnetic constants chosen as particularly applicable to receiver design. On the left-hand side of the sheet curve *A* relates to soft iron and is applicable to pole pieces and diaphragms, while curve *G* is for glass-hard steel, useful in connection with permanent magnets. The lower horizontal scale, beginning at the left-hand corner and reading to the right, gives the value of $\mathfrak{H}$ in gilberts *per centimeter of length* of coil; that is, if we suppose the magnetomotive force to be created by coil of wire supplied by a current, each centimetre of the coil must produce $\mathfrak{H}$ gausses. This is the intensity of the field, or number of lines of force, or number of maxwells per sq. cm, inside the coil, so long as it is occupied by air or other non-magnetic material. Now, suppose a piece of soft iron to be inserted in the coil, and the current traversing it to be slowly augmented so that $\mathfrak{H}$ may increase from zero to any desired amount. Instead of the flux Φ being numerically equal to and growing in direct proportion with $\mathfrak{H}$, as would be the case if the coil were occupied by non-magnetic material, it is found to be enormously increased, and by measuring the values of the flux with different values of $\mathfrak{H}$, a curve can be plotted showing the relation between them. Curve *A* is such a line. Scale No. 1 on the left-hand side of the sheet gives the number of gausses or maxwells per sq. cm in the iron, which is usually represented by a script letter, $\mathfrak{B}$. In order to exhibit the entire curve rather small

scales had to be chosen, but as for receiver design the lower portions of the curve are important, and the beginning of curve A is shown considerably magnified on the right hand of the sheet marked A'. The lower horizontal scale designated A' gives the value of $\mathfrak{H}$ in gausses for this curve and reads from *right* to *left*. Scale No. 2 on the left hand of the cut gives the corresponding values of $\mathfrak{B}$. When $\mathfrak{H}$ equals 1 (curve A') $\mathfrak{B}$ is found to be 1,550; with $\mathfrak{H} = 2.5$, $\mathfrak{B}$ is 6,250 (curve A) and this enormous increase in flux continues in nearly the same ratio till $\mathfrak{H} = 5$. It seems, then, as if the ability of the iron to carry the flux gradually became exhausted, and as $\mathfrak{H}$ is increased the ratio between $\mathfrak{B}$ and $\mathfrak{H}$ decreases until it finally falls nearly to unity. This curious property of iron to increase the flux has been usually explained by saying that the *reluctance* of the iron is much less than that of air, or in other words that its *permeability* is much greater. The symbol of permeability is the Greek letter μ and the points on the curves, A and A', may be expressed by the relation $\mathfrak{B} = \mu\,\mathfrak{H}$. In electrical parlance one would say that the iron was a much better conductor, or had much less resistance. It is improbable that this explanation is a correct one, but it forms the easiest working hypothesis that one can employ. By calculating the various values of μ in terms of $\mathfrak{H}$ from the formula $\mu = \frac{\mathfrak{B}}{\mathfrak{H}}$ a very useful curve may be plotted showing the reluctance of iron as compared with air for all values of $\mathfrak{H}$. Such a curve is shown at C (Fig. 13). The values of $\mathfrak{H}$ are shown on the same lower scale as for curve A, while the values of μ are given by scale No. 2 on the left hand. This curve rises suddenly from 0 to about 2,500, then abruptly turns and drops toward the horizontal axis, at first very rapidly and then slowly, till it nearly reaches unity. By means of the data exhibited in these curves, it is easy to determine for soft iron either the reluctance per cubic centimetre, the magnetomotive force needed to produce any desired flux, or the flux which will be obtained with any given value of $\mathfrak{H}$. For example, with a magnetomotive force of $\mathfrak{H} = 15$ gilberts per linear centimetre, the value of $\mathfrak{B}$ is 14,000 gausses, μ is 1,000, and the reluctance per cubic centimetre is $\frac{1}{1{,}000} = .001$ oersteds.

Curves G and G' contain similar data for hard steel such as might be employed for receiver magnets. There is a striking difference between the curve for steel and that for iron. At all points the value of $\mathfrak{B}$ for steel is much less than for iron with the same value of $\mathfrak{H}$, and consequently μ is correspondingly smaller. Again, the curve $\mathfrak{B}$ is less concave toward the horizontal axis, which means that steel, unlike iron, does not show so marked a saturation point beyond which it is difficult to push magnetization. Curve G' gives the value of μ for curve G in a manner similar to the data shown by curve C for curve A.

Steam Turbine Unit for Omaha Light and Power.

On account of the increase in its lighting and power business in Omaha, Neb., and the purchase of the central station in Council Bluffs, Iowa, the New Omaha Thomson-Houston Electric Light Company is planning improvements to its system and an important addition to its power station. This new addition will consist of a 1,500-kw Curtis turbo-alternator, four boilers and condensing apparatus. The power house of the company is located on the Missouri River in the eastern part of the city and at present contains five direct-connected units, the plant having been changed over from a belt-driven system about five years ago. Two of the units consist of 300 kw alternating-current generators, driven by 400-hp horizontal tandem-compound engines. Another engine of the same type and size drives a 300-kw alternating-current and a 325-kw direct-current generator on the same shaft, current being taken from either machine to meet the demands on the alternating and direct-current distribution. A 750-hp tandem-compound engine drives in a similar manner a 500-hp alternating-current and a 325-hp direct-current machine. The fifth unit comprises a 1,000-kw alternator driven by a 1,500-hp cross-compound engine. All of the engines are of the McIntosh & Seymour make, and the generators are General Electric machines. All five units are run in parallel with very little trouble.

The alternators are monocyclic, delivering current at 2,300 volts. The direct-current generators deliver a 500-volt current that is used principally for light and power purposes. Alternating current is distributed for lighting and power through 236-volt secondaries. Arc lamps in six series circuits of 100 lamps each are operated through constant-current transformers, the voltage varying from 7,500 to 8,000 volts. Service is supplied from the power house to South Omaha and Council Bluffs through 5,500-volt transmission lines, the power being distributed in those cities from transformer stations at 2,300 and 236 volts. A short account of the Omaha lighting situation, printed in the ELECTRICAL WORLD AND ENGINEER of November 24, 1900, gave a mere detailed mention of the monocyclic system and the South Omaha plant.

The new steam turbine unit will be installed in the present power house. It will be of the new Curtis vertical type as manufactured by the General Electric Company, and described in ELECTRICAL WORLD AND ENGINEER of May 23, 1903. The unit will have a speed of 900 r.p.m. and will deliver a 2,300-volt, three-phase, 60-cycle current. The capacity per phase will be 377 amp. The machine will have eight poles and will be designated as the company's A T B type. Its speed variation is not to exceed two per cent. from no load to full load, although a sudden variation may cause a four per cent. momentary speed fluctuation. The regulation is guaranteed to be within eight per cent., and for a 50 per cent. overload for two hours the temperature rise is not to exceed 55° C. The maximum excitation is to be 125 volts. The turbine unit is guaranteed to be capable of carrying a 100 per cent. overload momentarily without injury. It will operate on 150 pounds steam pressure or possibly on 200 pounds with superheat. A steam consumption of 20.5 pounds of dry steam per kw-hour is specified at full load and 22 pounds at half load. The turbine will be 16 ft. 9 in. high and will be 10 ft. in diameter at the base. Its weight is 125,000 pounds. According to contract, the unit is to be shipped in January, 1904. For condensing purposes in connection with the turbine there will be installed a 2,000-hp Worthington surface condenser.

The present boiler equipment of the Omaha Thomson-Houston plant comprises four 375-hp Heine, one 375-hp Edgemoor and five 125-hp tubular boilers. The tubular boilers are to be replaced by four 500-hp Babcock & Wilcox boilers, set in two batteries. They will be equipped with superheating coils and Babcock & Wilcox chain-grate stokers.

After the new turbine unit is installed it is the company's plan to change over the monocyclic to a three-phase system.

The company has just completed putting its wires underground in the central district of the city, the area extending ten blocks east and west and five blocks north and south. In the underground work there was used 250,000 ft. of cable, 400,000 ft. of duct and 25,000 ft. of Edison tube. McRoy & Camp conduit and bituminous paper duct were used. Practically all the construction lies in the alleys, and transformers of 20 to 50-kw capacity are located in manholes every block.

On May 1 the new Omaha Thomson-Houston Electric Light Company purchased the Citizens' Gas & Electric Company, of Council Bluffs, to which it had been supplying power for the past two years, the Citizens' Company having leased two years ago the Council Bluffs Gas & Electric Company, the original lighting company in Council Bluffs. The Citizens' Company has $150,000 capital stock and is bonded for $388,000. It will probably be continued under its present name.

As the Omaha Thomson-Houston Company acquired control of the South Omaha plant nearly three years ago (see ELECTRICAL WORLD AND ENGINEER November 24, 1900), it now controls the lighting and power situation in the three cities—Omaha, South Omaha and Council Bluffs. Steps are being taken to reorganize the company in order to issue new bonds and take up the old ones at a lower rate of interest. It is proposed that the new company issue $1,350,000 5 per cent. first mortgage bonds, $481,800 preferred cumulative 5 per cent. stock and $2,000,000 common stock to take care of its bonded indebtedness, floating debt, new improvements and the acquisition of the Council Bluffs property. It is probable also that a new name will then be adopted by the reorganized company.

In addition to the increase in generating capacity of the power plant spoken of above, there has been considerable talk of the company developing directly or indirectly some of the water powers that lie from 30 to 100 miles west of Omaha. There are said to be several excellent opportunities in that direction and the question of their successful development would depend upon receiving the lighting and street railway power in Omaha.

The officers of the new Omaha Thomson-Houston Electric Light

Company are as follows: President, Fred. A. Nash; vice-president, Henry W. Yates; secretary and treasurer, S. E. Schweitzer; directors, Fred. A. Nash, Henry W. Yates, C. E. Yost, George W. Holdrege and Guy C. Barton; general superintendent, R. A. McLaughlin; purchasing agent, W. B. Whitehorn.

London Conduit Railway System.

Last month the first section of the electric railway system of the London City Council was put in operation, comprising 8 miles of double track on Surrey side. A second section of 19¼ miles is now under construction, and a third section of 7 miles will soon be commenced.

A central power house for the completed system is being erected at Greenwich, current being at present supplied from a temporary plant. The order already placed for generating plant includes two 1,500-kw direct-current machines and three-phase machinery, consisting of two 1,500-kw alternating generators and eleven 300-kw motor-generator sets, and other small auxiliary sets, including small motor-generator sets and steam-driven exciters. Two 1,500-kw direct-current machines are coupled direct to Ferranti vertical engines. They are 12-pole compound-wound generators, and when running at a speed of 150 r.p.m. develop at full load 2,400 amp. at 625 volts. All of the electrical machinery will be supplied by Dick, Kerr & Co., which firm has also supplied the complete equipment of 200 cars for the section just opened. All the track work for the first section was done by Messrs. J. G. White & Co., under specifications of Dr. Alexander B. W. Kennedy, of Kennedy & Jenkins, which were somewhat modified to suit the circumstances.

The conduit system is employed, and in its construction some novel features were encountered, owing to the fact that the former horse car track was laid in concrete. It was found that the old method of breaking out the old construction with road spikes and sledges was not only slow but costly, and some other quicker method had to be adopted.

The margin of the old track on the outside was broken out just enough to permit the insertion under the concrete bed of special lever jacks. A distance of some 50 ft. to 60 ft. was dealt with at a time, and the jacks are spaced at about 4 ft. to 6 ft. centers, as the lifting resistance of the bed may require. The entire existing concrete bed and track was then lifted bodily, when it could readily be broken with spikes and sledges in the ordinary way from the top and removed.

Spaces were first cut in the trench for the cast-iron yokes, which are at 3-ft.-9-in. centers throughout the whole length of the conduit, after which the rails were put in place and aligned, and the conduit was built up by wooden molds. With the yokes as closely placed together as this a lighter form can be used, and in some ways it strengthens the construction, especially preserving the position of the slot rail and preventing it at all times from closing by outside pressure. The slot rail is of the Z-type, having a vertical web, and is constructed so that any surface water drops easily to the bottom

FIG. 5.—SLOT RAILS AND YOKE.

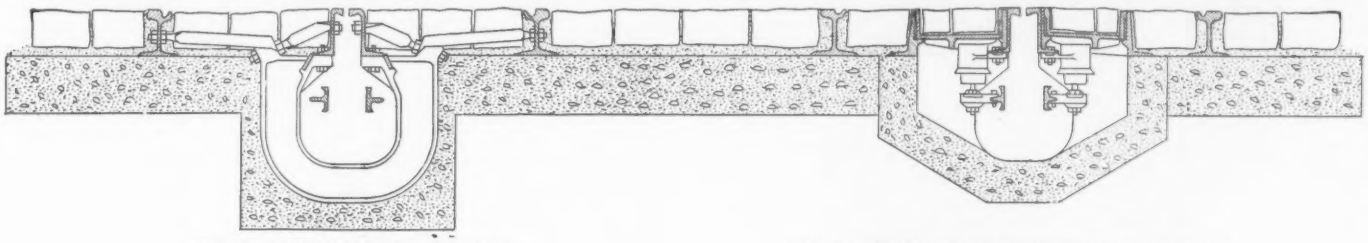
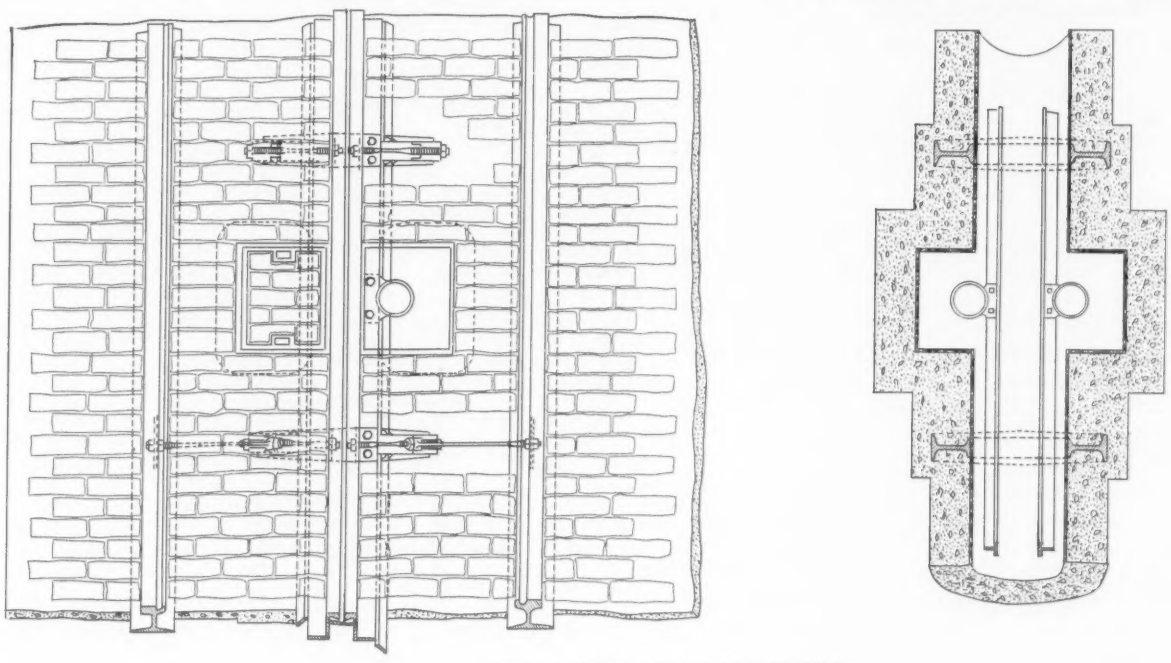


FIG. 1.—CROSS SECTION OF YOKE.

FIG. 2.—CROSS SECTION AT INSULATOR BOX.



FIGS. 3 AND 4.—PLAN AND SECTION.

of the conduit from which it is drained by special sewer connections. The service rails are 7 in. high, with 7 in. width of base, having a groove 1 1-16 in. wide for straight track and 1 3-16 in. on the curves. The tie-bars are attached not only to the slot rail and the yoke, but by extension pieces they are attached to the rail so as to preserve a perfect gauge. The wooden molds used for building up the conduit are in two parts.

The conductors used are similar to those employed in New

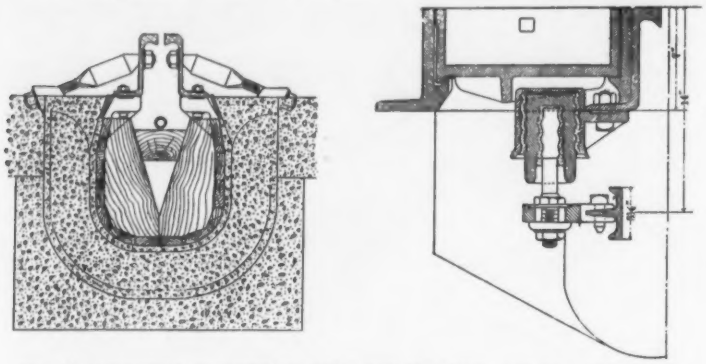


FIG. 6.—SECTIONS OF WOODEN MOLD FOR CONDUIT AND OF INSULATOR BOX.

York, and are supported by insulators every 15 ft. As provision has to be made for inserting or removing the conductor bars special gaps are left in the conduit, except where, as in most cases, the sump holes for draining the conduit to the sewers afford this facility. The conductor bars are fed into the conduit at the manholes and are suspended by means of special tools to small carriages running on the tops of the slot rails, and in this way are carried to the point where they are required and secured to each insulator; the necessary bonds for connecting electrically the adjacent T-rails are fixed in

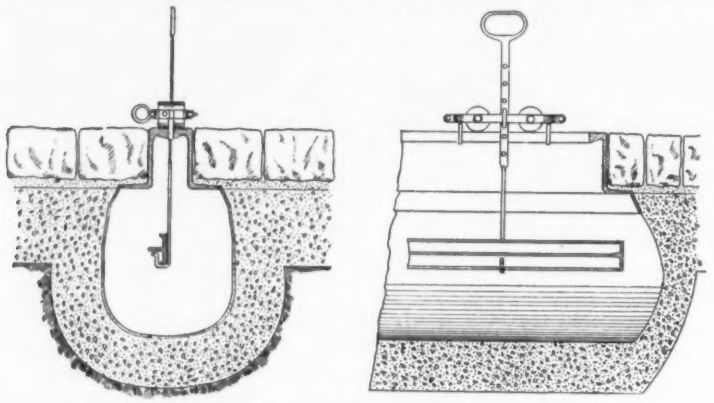


FIG. 7.—SECTION AND ELEVATION OF CONDUIT.

position by a special hydraulic press, which can be used through the insulator box opening.

Drainage sumps of ample size are provided at intervals of about 50 yards, as the grade of the road may require, and these sumps are trapped and connected to the nearest sewer.

Another point of interest in connection with the equipment of the lines was the fact that the present horse traffic was kept going during the reconstruction. Moreover, the vehicle traffic on the streets under reconstruction was considerable, so that provision and maintenance of a temporary track became an important factor, and necessitated a special flat section rail which would be surmounted without injury to springs of the passing vehicles.

A. S. M. E. Meeting.

The forty-seventh meeting of the American Society of Mechanical Engineers will be held at the United States Hotel, Saratoga, June 23 to 28. The programme includes papers on the following subjects: T. A. Waldron, on "Steam Turbines from the Operating Standpoint"; D. S. Jacobus, "Curves of Water Consumption for Various Horse-Powers of Several Engines"; W. I. Slichter, "Alternating-Current Motors for Variable Speed," etc. Trips will be made to the General Electric factories, Hudson River power plants, Union College, Schenectady, etc. The local committee has Mr. A. L. Rohrer as chairman and includes H. G. Reist, secretary; H. G. Hammett, treasurer; August H. Kruesi, J. F. McElroy, H. A. Moody, W. B. Potter, Prof. W. L. Robb, W. L. R. Emmet.

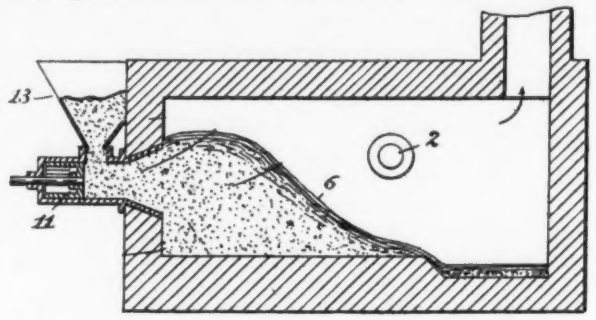
Recent Electrochemical Developments.

By Clinton Paul Townsend.

ELECTRIC FURNACE.

An electric furnace method patented by Carl Gustaf Patrik de Laval, of Stockholm, Sweden, is intended more particularly for the reduction and distillation of such volatile metals as zinc, the heat being radiated against the charge from an arc or incandescing conductor placed at some distance therefrom, thus following the lines of the Gibbs method for the distillation of phosphorus. The feature of novelty lies in the form given to the stack of the charge in the furnace and its position relative to the source of heat, the arrangement being such that the reduction of the ore occurs in the less intensely heated portion of the furnace whereby danger of a too rapid or even explosive liberation of gas is avoided. The reduced metal is continuously moved forward toward the source of heat, the final and quieter reaction involving the fusion or distillation of the metal occurring in immediate proximity to the arc.

The arrangement of the furnace is illustrated in the cut, in which



ELECTRIC FURNACE.

2 represents an arc, or incandescing carbon rod, and 6 the furnace charge; a hopper, 13, and reciprocating piston, 11, are provided for maintaining the form and dimensions of the latter. The reaction begins under the moderate temperature conditions at the peak of the stack, and is completed on its middle or lower slope, at the region of highest temperature.

Reference should perhaps be made in this connection to the simple furnace construction of Chavarria-Contardo, heretofore described in these columns (July 13, 1901). This furnace resembles the present construction in that it subjects the charge to the heat of an arc located out of contact with the material and in that the charge is subjeced to a progressively increasing temperature in the course of its movement through the furnace; it goes a step beyond the present construction, however, in that the escaping gases of reaction are utilized for a heating of the charge which is preliminary to the reduction.

New Telephone Patents.

AUTOMATIC PAY STATIONS.

For some few years automatic pay stations have been the subject of very general consideration among telephone men. The pay station has always been practically attractive as a source of revenue, but the difficulty of collecting for calls has at times been no mean one. Many of the early automatics were very crude, and it was possible not only to deceive the operator, but to rob the pay station, of

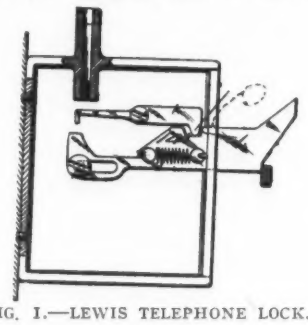


FIG. 1.—LEWIS TELEPHONE LOCK.

which possibilities certain persons were not slow to take advantage. The next difficulty with this type of apparatus was the substitution of slugs for coins. Then came the annoyance from the depositing of coins when the operator was not present upon the circuit, and the consequent disputes regarding the return of such coins. These

and other early difficulties bring us down to the pay station coin collectors of the present day. Of these, there are several types, and as evidence that perfection has not as yet been attained, we have for present consideration five patents just issued for coin collecting pay stations.

One of the most novel of these collectors is that by W. S. Paca, of Erie, Pa. The top of the box of this collector carries a central crank and a set of circular apertures, each of the exact size of a particular kind of coin. Immediately beneath the cover of the box are two metal plates, one moving with the crank and having apertures exactly to correspond with those in the top; the other stationary and mounted immediately beneath the movable plate. Annular slots are made in the underside of the cover, one for each aperture, and these are of such depth that taken with the thickness of the moving plate just sufficient vertical space is left for a coin of the thickness proper for that denomination. The crank is allowed a slight angular rotation, and when a coin is dropped in place, and the crank turned, the coin passes at once beneath the cover. As it progresses, it passes over an aperture in the stationary plate slightly smaller than its nominal size. If it be too small, it will fall through without result. If of proper size it will pass to a trigger, which being engaged will sound a distinctive gong, thus indicating its receipt. After sounding the gong, it drops through a second aperture in the stationary plate into the coin box. If a thin coin of proper diameter is tried, it will follow exactly this course, but will ride over the signal trigger. If a coin be once started under the cover it is impossible to return the crank until it has been deposited, as a ratchet prevents such return until such time as a lifting guard plate has raised the pawl at the end of the normal stroke.

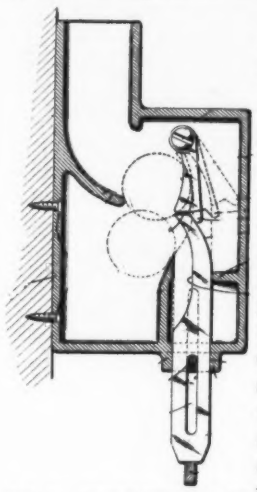


FIG. 2.—SCOTT TELEPHONE LOCK.

TELEPHONE LOCKS.

Two of the present patents are for "Telephone Locks," arranged to engage the switch hook of a telephone set until released by a coin. One of these, shown at the left of Fig. 1, is almost self-explanatory. The switch hook, shown in shaded section, engages a spring latch. When a coin is deposited, it trips the trigger, but is held in the slot until the latch has receded its full extent under the influence of the rising switch hook. The second lock is rather simpler than the first, and is shown in Fig. 2. The descending coin trips the trigger, and is held until the ascending latch opens a passage into the coin box. The patents for both these locks are assigned to the Controller Company of America, the former being the invention of E. G. Lewis and the latter of W. H. Scott.

COIN COLLECTOR.

Charles E. Scribner has patented the fourth coin collector under consideration and has assigned his patent to the Western Electric Company, of Chicago. Mr. Scribner's apparatus provides that in case an unsuitable coin is deposited, or in case the desired connection fails, the coin is returned to the depositor. It also provides for the return of a coin deposited in the slot, while another coin is within the machine and unused, a condition which sometimes exists. Still another feature of the device is that no signal can be given the central office until a coin is in the slot; and thus no useless annoyance is given the operators, such as false calls or waiting for change to be obtained. Fig. 3 shows two vertical sections of the collector. From that to the left it will be seen how a coin follows the slot until it strikes the pin, a^5, and drops between the pins, e^1 and e^2. The pin, e^1, is rigid, while e^2 is pivoted and held toward e^1 by a spring. When the coin drops between these pins, e^2 is pushed back and closes the normally open signal circuit, so that the rising of the hook may signal central. Only in case the coin is of normal size will it remain between these pins. If it is too small, it will fall through, and, striking projection d^3, will pass into the return chute. Now the pins, e^1 and e^2, are carried by the armature of a polarized relay, and either may be withdrawn from the coin slot by the central office operator at will, by the mere application of current of the proper polarity. If the connection fails, she withdraws, e^1; if it succeeds, she withdraws, e^2, the coin taking a course to the right into the coin box or to the left into the return chute. The return of a second coin deposited while another is already in place is evident, as striking the top of the unused coin, it is deflected into the chute around the pin, a^5.

PAY STATION SIGNAL.

A pay station signal is the subject of a patent granted to E. P. Baird. This signal is that which notifies the central office that a coin has been deposited. It consists of a tongue of sheet metal which is attached to the coin box and is in position to be plucked

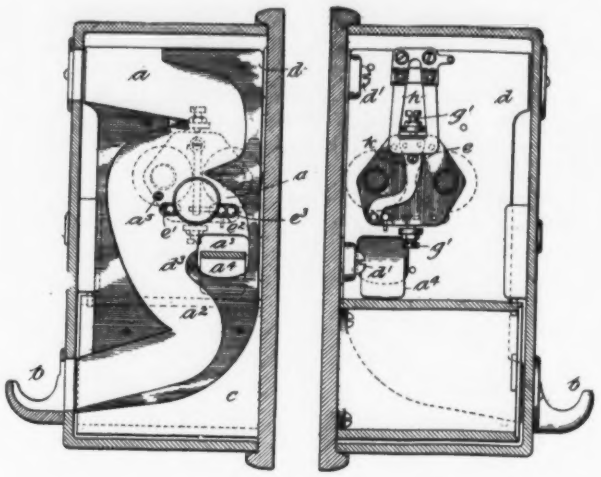


FIG. 3.—SCRIBNER PAY STATION.

by the coin-depositing apparatus. This spring can give three distinctive tones: first, when free to vibrate at its normal pitch; secondly, when its vibrating length is shortened by setting up a screw against it midway of its length; and, thirdly, when the screw is set up lightly so that it is tapped by the spring at each vibration.

SIMPLE CENTRAL ENERGY SYSTEM.

Of the other patents one of the more interesting is that of C. B. Smith, of New York City, which describes a rather simple central energy system, in which the auxiliary apparatus is reduced to a very few elements. The system has the disadvantage of using series spring jacks, but it has the advantage of a two-strand cord, which, from a maintenance point of view, somewhat offsets it. Fig. 4 shows the circuits of this system. It will be seen that both poles of the common battery are permanently connected to the subscriber's

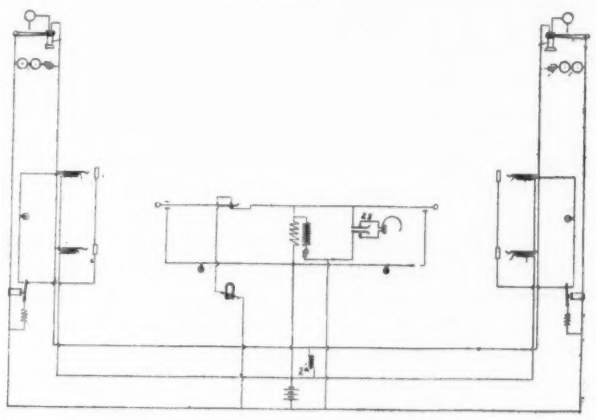


FIG. 4.—SMITH TELEPHONE EXCHANGE.

line; one directly and the other through a retardation coil. The closing of the circuit of a line causes the line relay to attract its armature and light the line lamp, the circuit of this latter passing through the series contacts of the several jacks. When a plug is inserted the line lamp circuit is opened, while a supervisory lamp circuit is formed involving the back contact of the relay. The lighting of the lamp in this circuit, therefore, corresponds to de-energization of the relay; i. e., the return of the receiver to the hook. The talking circuit also involves a novel feature, viz.: the use of an induction coil in the cord circuit, serving for both subscribers of any one connection. Thus, the primary circuit is traceable from the battery through the subscriber's line and instruments and the coarse winding of the cord circuit coil, while the secondary

comprises a bridge consisting of the fine winding of this coil and the condenser in series.

COMBINATION DROP AND JACK.

S. M. Ericsson, of Sweden, has invented a combination drop and jack which has the feature of causing a line to test busy as soon as a signal arrives. The drop coil is situated in the base of the jack and releases a spring-actuated telescoping sleeve, which, therefore, bounds forward, indicating the arrival of a call. As the sleeve moves forward, it contacts battery with the test ring circuit of the spring jacks. The insertion of a plug in the answering jack makes the normal test circuit, restores the sliding sleeve against the spring pressure and latches it ready to indicate another signal whenever the plug has been removed.

A receiver holder is the subiect of a patent to A. J. Briggs, of Allegheny, Pa. This consists of the usual receiver-holding clamp upon the end of an adjustable linkage. The novelty comprises a system of levers connected to the hook switch to render the depression of this a matter of convenience. A short adjustable transmitter arm has been patented by Wm. Kaisling. This arm is pivoted behind the plane of the inside of the hinged box cover, bringing the transmitter close to the box, yet giving a satisfactory vertical adjustment to accommodate persons of different heights. This arm is made tubular, and therefore forms a runaway for the cords, thus removing these from liability to abuse.

A "Vocal Guard," comprising a semi-flexible horn for confining the sound of the voice has been invented by W. J. Donihue. This horn can be clamped to the transmitter forming an air-tight joint. The outer edge is shaped to the face so as to contact with the chin, cheeks and bridge of the nose. Thus the voice of the speaker is confined entirely within the horn and cannot be heard by others in the neighborhood.

Mr. Y. S. Stone, of Boston, has obtained two more patents concerning features of his selective signalling system depending upon resonating circuits. Both new patents refer primarily to the simultaneous signalling of two or more stations, and both are assigned to the American Bell Company.

A pole-changer and a magneto complete the inventions at hand. The former is shown in several forms in a patent issued to Mr. J. Crawford, of Denver, and comprises a pole-changer designed to give not only alternating currents, but also to give positive and negative impulses for selective ringing. The improvement in magnetos consists of a built-up armature, the winding for which can be made up on spools within which the core can be assembled.

Data as to Western Union Pole Cutting.

According to data from Western Union sources, the Pennsylvania Railroad has cut down thus far 680 miles of poles and 9,813 miles of wire in Pennsylvania, and 245 miles of poles and 403 miles of iron wire along the Pennsylvania Railroad system in the State of Pennsylvania and the West Jersey & Seashore Railroad, in New Jersey. In no other States were any considerable amount of poles and wires cut down. The Western Union values the property destroyed at $1,000,000. The cash value of this property is conservatively estimated at $850,000.

Should the United States Supreme Court sustain the appeal of the Western Union from the United States Circuit Court, the Western Union will immediately bring suit against the Pennsylvania for this property destroyed and the damages resulting therefrom. On the other hand, should the appeal of the Western Union be dismissed by the United States Supreme Court, the Pennsylvania will sue the Western Union for the expense of cutting down and removing this property from land belonging to the Pennsylvania.

For the year ending June 30, 1902, the Western Union had 196,115 miles of poles and 1,029,984 miles of wires in operation. The total amount of property destroyed was 925 miles of poles and 10,216 miles of wire. This is less than one-half of 1 per cent. of the total mileage of poles and less than 1 per cent. of the total mileage of wires. As the Western Union is still operating its system in the State of Pennsylvania along the highway and on private rights of way, it is said that the loss in revenue to the Western Union is rather inconsiderable. Of course it does no business at stations of the Pennsylvania Railroad. Apart from that, it is still operated throughout the entire State. The loss of revenue to the Western Union will be exceedingly small and will, it is asserted, not in any way affect the dividend rate for 1903.

Earnings from Street Railway Operation.

The recent census office report on street railway operation in the United States showed gross earnings for the 967 systems of $241,584,697. It is now interesting to note some comparative figures compiled by the *Street Railway Journal* for 1902, from the data prepared for its annual volume of "American Street Railway Investments."

Thirty-eight companies report gross income of over $1,000,000, compared with 34 for 1901, every company showing an increase. This is somewhat remarkable, as 1901 was considered a successful year, while several causes, including the anthracite strike, affected 1902 earnings.

Nineteen roads each showed in 1902 gross receipts of between $500,000 and $1,000,000; 88 earned between $100,000 and $500,000; 65 between $50,000 and $100,000, and 58 between $25,000 and $50,000.

The average rate of increase of the receipts in 1902 over 1901 is, in the first group, 8 per cent.; in the second group, 16.3 per cent.; in the third group, 14.2 per cent.; in the fourth group, 10.4 per cent., and in the fifth group 17 per cent. The general average increase for 1902 over 1901 for the 268 companies compared is 9 per cent.

Gross earnings by groups compare:

	1903	1902.	Increase.
First group	$159,336,273	$146,579,211	$12,757,062
Second group	13,303,572	11,432,553	1,871,019
Third group	18,898,211	16,546,196	2,352,015
Fourth group	4,408,531	3,903,313	505,218
Fifth group	2,166,688	1,850,929	315,759
Total	$198,113,275	$180,312,202	$17,801,073

Assuming roughly that like periods are compared—which, of course, is not the case in all instances, it will appear that while 268 companies thus earned $198,113,275, the other 699 companies earned only $43,471,422, or an average of about $60,000 apiece. It may be pointed out, however, that the 268 companies are rarely single roads, but consolidations, as there are some fifteen or sixteen hundred street railways in the country.

CURRENT NEWS AND NOTES.

UNSIGHTLY ADVERTISING ON POLES.—With a desire to make Brooklyn's streets more sightly, Deputy Commissioner Van Iderstine, of the New York Department of Water Supply, Gas and Electricity, is about to begin a vigorous campaign against persons who have been using the telegraph and telephone poles for advertising purposes. Thousands of poles throughout the borough, says the commissioner, are thus defaced, in violation of the law, and are an eyesore to any one with the least ethical sense and civic pride.

POSTAL WIRES TO PACIFIC.—Officials of the Postal Telegraph Company have been in Omaha several days in consultation with the officials of the Union Pacific Railroad relative to construsting a line of wire from Omaha to San Francisco along the right of way of the Union Pacific road. It is understood from Union Pacific sources that while no definite arrangements have been made for securing the right of way to the Postal Telegraph Company, negotiations are still on and will probably result in securing the concession that will enable it to string a long stretch of wires parallel and competing with the Western Union. The Postal several months ago began the construction of a part of this line as a test case, and then awaited the outcome of the case of the Pennsylvania road.

WESTERN UNION-PENNSYLVANIA FIGHT.—It is stated that the Pennsylvania Railroad Company directors have appropriated $289,000 for the building of telegraph lines along the company's system east of Pittsburg and Buffalo, to replace the lines of the Western Union Telegraph Company recently destroyed. The Postal Telegraph Company will be permitted to string wires on the new poles, and it is expected that the new line will be finished before cold weather sets in. On June 5, counsel for the Western Union Telegraph Company filed a petition in the United States Circuit Court at Baltimore for condemnation of a right of way for its poles and wires along the line of the Pennsylvania Railroad between Philadelphia and Washington. The petition claims the right to condemn under an act of Congress passed on July 24, 1866, which provides for the right of telegraph companies to construct their systems along the post roads of the United States, it being contended that the Pennsylvania Railroad is such a road.

COLLISION IN LONDON TUBE.—A cablegram from London of June 5 says: The failure of a brake to work caused a collision on the Underground Railway at Westminster this morning. Five persons were slightly injured and traffic was completely disorganized. One locomotive was derailed.

BAPTISTS BAR BABBLE.—At Goshen, Ind., on June 3, the old order of German Baptists, whose national conference closed at Wakarusa, voted not to permit its members to use telephones in their homes. Nearly five thousand people attended the conference. Indiana has been one of the great centers of the independent telephone movement.

AUTOS FOR ST. LOUIS.—It is stated that a syndicate of St. Louis merchants is contemplating the establishment of an automobile line to the Louisiana Purchase Exposition in 1904 from the stations and hotels. According to the plans several hundred electric omnibuses will be employed, and the company will have a capitalization of $1,000,000. The promoters estimate that from 8,000 to 10,000 persons an hour could be handled in the automobiles, thus relieving the regular transportation lines to that extent. Meantime the trolley lines are also making extensive plans and arrangements.

LIGHTNING EXPLODES MINES.—A cable dispatch from Paris of May 30 says: "The *Matin's* correspondent at Cherbourg telegraphs that while a violent storm was raging yesterday afternoon lightning caused the explosion of three submarine torpedoes at the west entrance to the harbor. The explosion threw up a column of water to a great height and caused a panic among the vessels at anchor. No damage was done, but the Hamburg-American liner *Fuerst Bismarck,* on her way from Hamburg and Southampton to New York, had just entered the harbor. Had the explosion occurred a few minutes earlier it might have caused a great disaster."

FRUSTRATING COMPETITION IN VIENNA.—A cable dispatch from Vienna of May 30 says: "Mayor Dr. Lueger has ordered the hook and ladder companies, by a general alarm, to stop the International Electrical Company from making connections without special permit. Wherever the American monopolists attempt to tear up the pavement or string wires, the fire laddies turn the hose on them and drive them out of business, unless properly authorized. Lueger has started a municipal electrical plant and will not permit its business to be interfered with or reduced by private concerns." The use of the word "monopolists" is rather amusing, in view of the fact that the public "monopoly" is the source of the trouble.

ROMANCE OF A TELEPHONE BOOTH.—A note from Chicago remarks that modern invention made an elopement easy for Mary Schultz, nineteen years old, but trouble came thereafter. Miss Schultz is a Joliet girl, and when her father, John Schultz, stepped into a telephone booth she saw her chance and seized it. Slamming the door of the booth, she turned the key, and then, with her father locked in, she went to another telephone and called him up. "Papa," she said, "you're whipped. I am going to run away with Harry Cowan, and—I'm—going—to—do—it—right—away." Run she did, but Schultz broke out of the telephone booth and followed them to Chicago by the next train. Then he caused Cowan to be arrested on a charge of abduction.

INDUCTION MOTOR.—A patent granted May 26 to Mr. Hans S. Meyer, of Rugby, England, on a method of reducing to a minimum the wattless current required by induction motors. For many purposes induction motors must have a large starting torque, and if they are designed with this point in view, they will take a large magnetizing current and will, therefore, load the mains with wattless current, when running under normal load as well as when running at light load. The inventor proposes to obviate any excess of magnetizing current without reducing the starting torque or the output of motor. He points out that the starting torque and the output are proportional to the square of the potential at the motor terminals, while the magnetizing current is directly proportional to the potential; hence the desired results can be obtained by means of a regulating device which operates automatically to adjust the potential at the motor terminals in such a manner as to cause it to increase with an increase of the load on the motor and to decrease with a decrease of the load. This regulating device is actuated by electromagnetic means, according to the load.

CONSTRUCTING PLANTÉ PLATES.—A patent issued May 19 to Joseph Bijur describes a method of constructing Planté plates of the type consisting of panels of fine lead strips or shreds between horizontal and vertical solid supports. The panels are supported in a mold and separated vertically by horizontal strips the width of the panels and which later form continuous horizontal bars. Tubes project into the channels left for the vertical supports. After the mold and its contents are heated above 200° F., lead or a lead alloy is poured into the tubes, which latter are gradually withdrawn until finally the channels are entirely filled with lead. By this means the molten lead is not flowed along the unoccupied part of the channel, but is deposited at the place where it is to solidify and fuse into union with it the cross-bars and lead strips.

INDUCTION MOTOR ARMATURE.—A patent was granted on May 26 to Prof. Elihu Thomson for an improvement in the mechanical construction of armatures of induction motors of the squirrel-cage type. Heretofore it has been the practice to make each lamina a complete ring where the diameter of the armature is small, and to cut the ring into halves, thirds or slightly shorter segments where the diameter of the armature is greater, and to punch therein a large number of slots for the conductor bars. In cutting or punching such rings or segments for armatures of different diameters it is necessary to cut the rings also of different diameters. This necessitates the use of special dies for each size of the armature. Prof. Thomson proposes to cut the segments much shorter than thas been the practice heretofore, and shapes their ends so that adjacent pieces may be assembled at different angles to each other. This construction permits the same segments to be used in armatures of varying diameters, and in the manufacture of squirrel-cage armatures the conductor bars not only do not interfere with the assembling of the segments, but they may be used to bind the segments together. This construction does not require any expensive dies and renders available almost all of the sheet-metal stock, while making it possible to make the outer surface of the armature smooth or slotted, as desired.

ARC LAMP REGULATION.—A patent was granted May 12 to Mr. Albert G. Davis on a method of regulating arc lamps on constant-potential, alternating-current mains, whereby the current in the arc is maintained constant, not through the regulating action of the carbon-controlling mechanism, but through the interaction of lagging and leading currents flowing in circuits operatively related to the lamp. Across the mains is connected for each lamp a circuit for supplying current to an arrangement somewhat similar to a Wheatstone bridge and designated under "monocyclic square." Two opposite sides of the square are formed by reactance coils, while the two remaining sides include sources of leading currents, such as condensers. It is possible to produce leading currents in these two latter sides by means of a single condenser, if the latter is connected with the secondary windings of two transformers, the primaries of which are directly in the two sides of the "monocyclic square," in which the leading currents are to be produced. The arc light terminals and the arc-striking coil of each lamp are connected in series across the diagonal of a bridge. The two opposite reactance coils in the monocyclic square, instead of forming separate pieces of apparatus, constitute regulating coils on the lamp magnets, these coils acting in opposition to the arc-striking coil. By a suitable proportioning of the condenser effect with respect to the reactance coils in the square, a constant e.m.f. can be made to give rise to a constant current in the bridge circuit of the "monocyclic square." As the length of the arc increases, the e.m.f. necessary to maintain constant current in the arc likewise increases, the increase in e.m.f. of this constant current or arc circuit being accompanied by an increase of current in the sides of the "monocyclic square" and also in the supply circuit from the mains. This fact the inventor takes advantage of to secure regulation of the arc. As the arc lengthens, due to the action of the arc-striking coil, the currents in the reactance coils in the two opposite sides of the monocyclic square increases, thereby opposing the action of the arc-striking coil with gradually increasing force. A point of equilibrium is finally reached at which no further lengthening of the arc takes place. By suitable adjustment this point may be made to correspond to any desired length or e.m.f. of the arc, which may be either greater or less than the e.m.f. across the mains.

WEIGHTS ON BROOKLYN BRIDGE.—To relieve the dead weight on the Brooklyn Bridge, Commissioner Lindenthal has ordered the removal of many of the wires belonging to telegraph and other companies. Last week the sixteen cables belonging to the Stock Quotation Telegraph Company and the Gold & Stock Telegraph Company were taken down. The new cables of these companies have been laid over the bed of the river.

ROTARY CONVERTER CONNECTIONS.—A patent was granted on May 19 to Mr. Alexander D. Lunt for a "system of electrical distribution" which, when applied to a rotary-converter, largely reduces the heating of the armature conductors and at the same time improves the commutation of the machine, thereby increasing the output and improving the efficiency. When applied to a twelve-phase converter, the system is as follows: The three primary windings of a transformer are connected to a three-phase supply circuit, and are in inductive relation to twelve secondary windings, each primary being in inductive relation to four secondaries. The secondary windings are interconnected in such a way that they form three distinct polygons of electromotive forces, two of the polygons representing a triangular relation of electromotive forces and the third a connection of electromotive forces in such a way that they may be represented by a hexagon. From points in the connections which interlink the various secondaries, leads extend to the 12 collector rings of the twelve-phase converter. The effect of this arrangement is that the currents which circulate in the transformer windings are in phase with the electromotive forces induced therein and are, therefore, of minimum value. This permits the use of a minimum amount of copper, securing decreased cost and increased efficiency. Another advantage is that the cross-connection between the various points of the armature winding afforded by the various secondaries thereto, serves to balance the electromotive forces acting about the armature winding and thereby prevents large and useless cross-currents in the armature winding, so securing better commutation.

POWER TRANSMISSION UNDER DIRECT CONTROL OF THE OPERATOR.—A patent was granted on May 26 to Mr. Harold W. Buck for a means of transmitting a motion synchronous with that of a controller operated by hand or otherwise, yet with any required augmentation of the power, so that a mechanism at a distance may be driven at proper speed or power, and under the direct control of the operator either from a single place or from any one of several positions. The receiving device is electrically connected with the transmitting device through intermediate direct-current generators, which provide the means for the required augmentation of the power. The transmitting device is connected between the field windings of these direct-current generators and any convenient source for successively carrying the field excitation of these machines through complete cycles (from a positive maximum through zero to a negative maximum, etc.). The transmitting device is rotateable, and by operating it at any desired speed, the e.m.fs produced by the several generators are caused to vary gradually in like manner as the fields are varied, the variations in the e.m.f. of one machine following those of the other, so that the currents produced in the armatures of the generators have their corresponding values displaced in time by an amount depending on the speed of operation of the transmitting device. While the transmitting device is being rotated, the currents generated in the machines have all the characteristics of alternating currents displaced in phase, and have constant values when the transmitting device is at rest. The receiving device is similar in its general construction to the ordinary polyphase motor. By this method it is possible to successfully control the application of large powers, involving the use of powerful currents without introducing or removing resistances in the circuit of the receiving device, the system being controlled by varying only the small currents which are required for exciting the fields of the generators.

RECTIFIED CONSTANT CURRENT FROM CONSTANT-POTENTIAL ALTERNATING CURRENT.—A patent was granted on May 19 to Mr. Edwin W. Rice, Jr., for a system of electrical distribution by which a rectified constant current may be obtained from a source of alternating current of approximately constant potential. The three-phase currents of the supply network are first passed through a device transforming from constant potential to constant current. This transforming device consists essentially of a closed circuit including inductance coils and condensers alternately arranged, and of proper magnitude. This arrangement may be diagrammatically represented by a triangle, each side of which contains an induction coil and a condenser; the mains carrying the constant-potential alternating currents are connected to the three corner points of this triangle, and the three circuits carrying the constant effective alternating currents are connected each between one corner point and the middle of the opposite side (this middle being the point separating the induction coil and the condenser of this side). To render the constant effective current circuits thus obtained electrically independent of each other, the mains carrying these three currents are connected to the primaries of three transformers. The secondaries of the same are connected to rectifying commutators, which are driven in synchronism with the waves of the alternating current; for instance, by means of a synchronous motor,. These rectifying commutators are connected, in series with each other, to the consuming circuit, containing, for instance, arc lamps. To reduce the maximum potential difference between any two points of this circuit, some of the arc lamps may be interposed in a circuit joining each pair of rectifying commutators in series, this arrangement being commonly designated as a "multi-circuit" connection. In case independence of the constant-current circuits is not desired, the transformers between the constant-potential, constant-current transforming device and the rectifying commutators may be omitted and the whole arrangement thus greatly simplified.

ELECTRIC REGULATOR.—A patent was granted on May 19 to Mr. Edwin W. Rice, Jr., for an electric regulator, in which the regulating action is checked as soon as the proper regulating effect has been secured without permitting the regulating action to pass through a series of oscillations or surges of decreasing amplitude about the desired point; in other words, the phenomenon of hunting or pumping of the regulator is avoided. The regulator, which may be of any kind, is governed in its motion by a special mechanism which contains three electrically-controlled contacts, a main contact and two co-operating contacts; all respond to variations of the quantity to be regulated (for instance, the voltage of the system), but the two co-operating contacts are subject to less movement than the main contact for any given variation, and means are provided for causing the co-operating contacts to return to normal position at a slower rate than the main contact. Under very small variations, the regulator controlled by the contact-making device is actuated by the main contact, as though the co-operating contacts were fixed. If, however, a large variation of voltage were to occur on the mains—as, for example, a drop in voltage of 15 to 20 volts—then the main contact instantly moves into engagement with its co-operating contact, and the regulator is turned quickly and continuously in a direction to raise the voltage of the mains; this action continues uninterruptedly until the voltage has been brought back within say a volt or two of normal, whereupon the main contact separates from the co-operating contact and commences to return to its normal position. As soon, however, as the separation takes place, the movement of the regulator ceases. In the mean time, the co-operating contact slowly returns until contact is again made with the main contact, whereupon the regulator is again moved, thus bringing the voltage of the mains still closer to normal value. The main contact then again moves away from the co-operating contact toward its normal position, again causing a separation and a repetition of the action described, until the voltage of the mains is brought back to normal, this action taking place without the liability of the regulating action going beyond the amount required.

LETTER TO THE EDITORS.

Hieroglyphic Designations of Apparatus.

To the Editors of Electrical World and Engineer:

SIRS:—Does it ever occur to the editors of technical journals that many of the readers whom they serve are not so fortunate as to have their names on the mailing lists of manufacturing companies, and, therefore, are not kept supplied with the trade literature of such companies? This query is occasioned by the frequent occurrence in descriptions of trade designations of apparatus or appliances, the writer often taking it for granted that the jotting down of such designations relieves him from conveying further information respecting

the said apparatus or appliances. It is, to say the least, annoying to the uninformed reader when he comes to the most important detail of an operation, to be informed that this is effected by a "Mark-X-006 Robinson gyro-inductor"; or that some salient feature is the "Well-known Smithson Type Z 4-11-44 Apparatus," when said apparatus is in fact unknown by such designation except to the fortunate few who receive the trade bulletins or catalogues of the Smithson Company. The appearance of these strange prefixes is also apt to excite in the mind of the reader a suspicion that the article containing them is from the same hand that prepared the aforesaid trade matter; for who else would have stored in his mind for ready use such arbitrary combinations?

There may be reasons unknown to the writer why such empirical trade designations may not be neglected in descriptions, but if obligatory, why not relegate them to one or more final paragraphs containing the names of the several manufacturers with whom the purchaser of the plant dealt, together with an enumeration of the respective articles they supplied, wedded to their respective hieroglyphics.

CHICAGO, ILL. J. L. CROWELL.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Size Constant of Dynamos.—ROTHERT.—A communication in which he refers to some recent remarks of Arnold, and discusses the use of the "machine constant," as Arnold calls it, or "size constant" (Groessenkonstante), as the present author prefers to call it, in dynamo design. He gives the following formula: the size constant equals the iron cross-section, multiplied by the iron breadth, multiplied by the number of revolutions, divided by the capacity in watts. He always uses this formula for the first calculations in the design of a new machine. He proceeds in such a way that for a given size constant he makes the calculations by varying the numerical values, and then chooses a set of values which seem to be the most convenient. Except in very extraordinary types, he thus gets a good starting point for the following exact calculation. The above formula is a good means for comparing roughly various machines with regard to economical design. It would, however, be wrong to overestimate this formula; it only determines the dimensions of the armature. He has collected from his experience numerical data for the size constant; for a machine of about 100 kw it is 350 and for high-speed machines it becomes about 270 at 1,000 kw, while for slow-speed machines it becomes 250, considerably below 1,000 kw. —*Elek. Zeit.*, May 21.

Polyphase Motors.—HAHN.—A highly mathematical article, in which the author discusses the influence of the shape of the current curve on the efficiency. His conclusions are: The sine curve gives the highest efficiency for the rotor, while the peaked and trapesoid curves cannot produce any material improvements. The peaked and trapesoid curves on the other hand influence materially the total efficiency of the motor, as they lower the total loss to a great extent. The peaked curve is the most favorable form.—*Elek. Anz.*, May 24.

Induction Motors with Commutators.—ALEXANDER AND FLEISCHMANN.—An article illustrated by diagrams, in which they give a simple explanation of the main phenomena which occur if an armature provided with a Heyland commutator is used in a revolving field. In connection with this general problem they discuss the use of an ordinary commutator; that is, one without Heyland's connections between the segments, for the purpose of avoiding the phase difference between e.m.f. and current. The paper gives a systematic and simple explanation of the phenomena which are known to exist in such motors.—*Zeit. f. Elek.*, May 10, 17.

Induction Motors with Commutator.—BRAGSTAD.—A continuation of his theoretical article on polyphase induction motors, with commutator, and with shunt excitation. He gives the diagram representing the action in such motors.—*Elek. Zeit.*—May 21.

Failure of Direct-Current Dynamos to Generate.—PARHAM.—An article enumerating the various reasons why direct-current dynamos sometimes fail to generate. The author also gives various ways of ascertaining whether or not a dynamo has lost its residual magnetism.—*Amer. Elec.*, May.

LIGHTS AND LIGHTING.

Special Connections of Lamps.—BOJE.—An illustrated article pointing out the saving which can be obtained in many lighting installations by special systems of wiring. The case in point is the lighting of a river front of 800 meters length with 10 arc lamps of 12 amp.; they had been connected in pairs in series across the 110-volt mains, the current being supplied by a 2 x 110-volt, three-wire system. It is stated that a considerable saving in electric power could have been accomplished if it had been possible to light only those lamps which were needed at any one time. This may be done by connecting each arc lamp by means of two wires to a plug which may be inserted in a switchboard. In an estimate he shows that the additional expense for copper in the first installation would have been covered by the saving in power in one and a half years.—*Elek., Anz.*, May 3.

Sirius Lamps.—An article on the Sirius lamp, which is an incandescent lamp made by a German firm, according to patents of Fernery. A higher economy is claimed, although the life is more limited. The color of its light is between that of the ordinary carbon incandescent filament lamp and the Nernst lamp; the price of the Sirius lamp is about the same as that of the ordinary incandescent lamp. Nothing is said concerning the preparation of the filament. The results are given of some comparative tests of Sirius lamps and ordinary incandescent lamps, in the form of tables and diagrams. The candle-power of the Sirius lamp decreases in 200 hours from 15 to 10, the ordinary incandescent lamp from 17 to 15, the watts per candle increase with the Sirius lamp in the same time from 2.4 to 3.5, in the ordinary incandescent lamp from 3.1 to 3.2. It is said to be a special advantage of the Sirius lamp that its absolute life and economical life are nearly equal, about 180 hours.—*Elek. Anz.*, May 10.

POWER.

Induction Motors in a Factory.—CRAVATH.—An illustrated description of the plant of a glass factory at Rosford, Ohio. The generating station has a capacity of 4,350 kw; there are twenty motors of 450 hp each, twenty of 200 hp each, ten of 50 hp each, and fifteen of 5 to 10 hp; all are three-phase induction motors, since the conditions in this class of manufacture are such that the work would be very trying for direct-current motors on account of the escaping gases and products of combustion from the furnaces in some places and the dust which collects in other places. The motors are wound for two speeds at a frequency of 40 cycles; and since for polishing glass three speeds are needed, an additional current supply is provided at 25 cycles, which gives the third speed. When the polishing table is first started, its motor is connected to the 25-cycle circuit; later it is thrown on the 40-cycle circuit at slow speed, and finally brought to full speed on the same circuit. The motors are started with the polishing wheels on the glass plates, which necessitates a starting torque equal to if not exceeding the running torque. The controllers are similar in external appearance and operation to street railway controllers, and they make the various combinations required by the three speeds on a contact drum, like in street railway controllers; the main circuit, however, is broken by a special switch operated by a movement of the controller handle, this switch taking all of the arcing and so relieving the contact drum from deterioration due to that cause. The power plant contains four generating units of 4,000 kw and one unit of 350 kw. These generators all give three-phase, 40-cycle currents at 580 volts. There is also a motor-generator, the motor of which is a 40-cycle, 300-hp machine, and this drives a 25-cycle, 330-volt alternator and a 125-volt, direct-current generator, having an output of 800 amp.; this generator is used as an exciter and for furnishing current to traveling cranes and transfer cars. The ordinary operation of the plant calls for the running of the four

1,000-kw units simultaneously, but these are not ordinarily run in parallel.—*Amer. Elec.*, May

Tests of a Belgian Engine Using Superheated Steam.—An article with illustrations and tables giving the performance of a horizontal tandem-compound 250-hp Van den Kerchove engine, tested by Prof. M. Schröter, of Munich. The economical performance of the engine was unusually good, the steam consumption with saturated steam being only 11.82 pounds per indicated hp per hour under load, with the most favorable period of admission. On no load, the steam consumption was 13.7 pounds. The rate of consumption at 256° superheating was 9.62 pounds of steam, which dropped to 8.99, with superheating of 343° F.—*Amer. Elec.*, May.

REFERENCES.

California.—Wright.—An illustrated historical article on long-distance, high-tension transmission of power in California, dealing with the historical development and present status of the subject.—*Scien. Am.*, May 16.

Large Gas Motors with Electric Transmission of Power.—A popular article, discussing some conditions under which such installations might prove profitable.—*Glueckauf*, May 23.

Some Difficulties of Long-Distance Electric Transmission.—Lincoln.—An abstract of his paper read before a meeting of the Electric Club, of Cleveland.—*Amer. Elec.*, May.

Richmond-Carey Electric Lift.—A short illustrated article dealing with the construction of this type of lift.—Lond. *Elec.*, May 22.

Traction.

Traction on Canals.—Szasz.—An illustrated description of a new system of electric traction on canals devised by Ganz & Co. for a competition in relation with the Teltow Canal in Germany. The system generally used up to the present consists in letting an electric locomotive run without rails on the path along the canal and drag the ships; but this system requires a very good path and is expensive in the cost of road construction and maintenance; moreover, the unavoidable vibrations of the locomotive are a disadvantage and the driver has a great responsibility. If two rails are used on which the locomotive runs, the roadbed construction is less expensive, but there is the serious disadvantage that the adhesion is not sufficient for dragging heavy boats, unless very heavy locomotives are used; the roadbed construction becomes still cheaper if a single rail is used, but the adhesion difficulty is still in existence. This difficulty is overcome by means of an idea of Fabre, developed by Ganz & Co.; instead of the usual two-wheel axles, each with two vertical wheels, they use two-axle pairs inclined against one another; on each axle a wheel is mounted, and each pair of two such wheels grips the single rail. To support the locomotive, one broad lateral wheel is provided which runs on the road. The purpose of this arrangement is to increase the adhesion and stability of the locomotive. The construction is described in detail and illustrated with diagrams. The author finally compares the cost of this system with that of three others designed for the same canal, which has a length of 3.7 km, with an annual traffic of 1,500,000 tons. In the cost of operation the price of 3 cents for one kw-hour is assumed. The first cost is as follows: for the Siemens & Halske system, $625,000; Rudolf system, $649,000; Ganz system, $251,695; the cost of operation per ton-km is: for Siemens & Halske, 0.27 cent; Feldmann & Zehme, 0.167 cent (first cost not given); Rudolf, 0.15 cent; Ganz, 0.103 cent.—*Zeit. f. Elek.*, May 3, 10.

Petrol-Electric Automobile Omnibus.—A note on a recent trip made in London with an automobile omnibus; the primary source of power is a four-cylinder petroleum engine, which drives a dynamo, the current generated in turn driving two electric motors, which are geared to the rear wheels of the omnibus. Storage cells are also provided to which current may be diverted when the vehicle is at rest or when running down hill. The object is to provide a reserve of power for extraordinary occasions, thus enabling a smaller engine to be used than would otherwise be needed for starting and climbing hills. The speed is controlled by an ordinary series-parallel controller.—*Eng'ing*, May 8.

REFERENCES.

Suspended Railroad.—A note on the project of a railroad of the above type for the City of London, to cross the River Thames. Electricity will be the motive power.—*Scien. Am.*, May 16.

Mersey Railway.—The conclusion of the article previously noted in the Digest, containing an illustrated description of the track construction and rolling stock.—Lond. *Elec.*, May. 22.

Installations, Systems and Appliances.

Testing of Alternating-Current Switches and Fuses.—Howe.—A short article in which he gives some formulas to show that the severity of a test on the circuit-breaking capabilities of a switch or fuse is not only dependent on the current and voltage, but also on the power factor. For a given current and voltage the test is severer if the current lags. A very convenient method of testing switches and fuses is to put them in circuit with a number of choking coils, which, by means of variable air-gaps and alternative connections, allow of a wide range of currents and voltages. The power factor being low, makes the test more severe than is perhaps necessary, but this is certainly a good fault, and can be allowed for.—Lond. *Elec., Rev.*, May 1.

REFERENCES.

Wiesberg.—Stoeger.—A detailed illustrated description of the hydroelectric plant of Wiesberg in Tyrol destined chiefly for the electrochemical works at Landeck. In view of the motor load and of a prospective traction load, three-phase current at 12,000 volts and 40 periods per cycle was chosen; three 1,000-kw generators have been installed, with room for three more. In the electrochemical works of Landeck calcium carbide, pure silicon and silicon copper are made, and it is intended to also undertake other electrochemical work.—*Elek Zeit.*, May 14.

Worcester, England.—An illustrated article describing the new works. Steam is supplied by three Babcock & Wilcox boilers, driving three triple-expansion Bellis engines, two of which are connected each to one 250-kw dynamo and one to a pair of 125-kw dynamos. A battery of 250 Ashmore cells is also installed. Current is mostly used for traction purposes.—Lond. *Elec.*, May 22.

Electric Installation of a Farm.—Grundmann.—An illustrated description of a lighting and transmission plant on a farm near Leipzig, Germany. It supplies current for lighting the residences and various industrial buildings, for power purposes and for a small railway. A 20-kw, 240-volt dynamo gives direct current and a storage battery sub-station is provided which is charged during the day and gives the lighting current for the residence bulidings during night hours.—*Elek. Anz.*, May 10.

A Simple Form of Circuit-Breaker.—Kintner.—An illustrated article describing a simple form of circuit-breaker and giving directions for its construction. The breaker consists of a strip pivoted at the center, one end of which contains contacts dipping into mercury, the other end being under the influence of an electromagnet.—*Amer. Elec.*, May.

Electro-Physics and Magnetism.

Radio-Active Change.—Rutherford and Soddy.—A long paper in which the authors discuss the products of radio-active change and their specific material nature, the synchronism between the change and the radiation, the material nature of the radiations, the law of radio-active change to chemical change, and the energy or radio-active change and the internal energy of the chemical atom. Radio-activity, according to our present knowledge, they say, must be regarded as the result of a process which lies wholly outside the sphere of known controllable forces and cannot be created, altered or destroyed. Like gravitation, it is proportional only to the quantity of matter involved. Assuming that an atom of radio-active matter cannot produce less than one and not more than 200 "rays" or projected particles, the authors deduce 10^8 gramme cal. per gramme as the least possible estimate of the energy of radio-active change in radium. As the reaction which sets free more energy for a given weight than any other chemical change known, namely the union of hydrogen and oxygen, liberates only approximately 4,000 gramme cal. per gramme of water produced, the energy of radio-active change must be at least twenty thousand times, and may be a million times as great as the energy of any molecular change. Calculating the rate at which this store of energy is radiated, the authors deduce that in one gramme of uranium and thorium less than a milligramme would change in a million years. In the case of radium, however, this amount must be changing per gramme per year. Therefore, the "life" of the radium cannot be more than a few thousand years, on this minimum estimate, and it appears certain that the radium present in a mineral has not been in existence as long as the mineral itself, but is being continuously produced by radio-active change.—*Phil. Mag.*, May. A long editorial on this paper is in Lond. *Elec.*, May 22.

Influence of Radium Rays on Organisms.—Bohn.—An account of experiments made to investigate whether, to the destructive action

of radium rays upon animal tissues, there would correspond, on homœopathic principles, a stimulating action when applied in small doses. He discovered such a stimulating action by exposing larvæ of frogs and toads to radium rays. Some larvæ showed a decided acceleration of growth, others a diminution. If the animal is exposed at an early age to radium rays for a few hours, an abnormal development is produced at a later age which remains latent in the interval. —*Comptes Rendus,* April 27; abstracted in Lond. *Elec.,* May 15.

REFERENCE.

Radio-Activity from Snow.—WILSON.—A description of experiments made with freshly-fallen snow; the experiments were made in the same way as the previous ones with freshly-fallen rain. There is no indication of any difference in the intensity of the radio-activity obtained from equal weights of snow and rain.—*Proc. Cambr. Phil. Soc.,* 12, part 2; abstracted in Lond. *Elec.,* May 15.

ELECTRO-CHEMISTRY AND BATTERIES.

Solution in Amyl-Amine.—KAHLENBERG AND RUHOFF.—An account of an experimental investigation of the electrical conductivity of certain solutions in amyl-amine. The molecular conductivities were found to be very small; this is interesting in studying the rôle of the solvent in causing electrolytic conduction. In these amyl-amine solutions the ability of the solvent to produce with the solute a liquid having electrolytic conductivity is slight. From the point of view of the Nernst-Thomson theory, the conductivity of solutions in amyl-amine is relatively high as compared with solutions in chloroform and ether. A comparison of existing data on the conductivities of solutions in solvents in a certain series would indicate that the conductivity of the solutions diminishes as the solvent occupies a higher position in the series. This behavior is similar to that found in other homologous series of solvents: the series of the primary alcohols, of which water may be considered as the first member, presents a typical example.—*Jour. Phys. Chem.,* April.

Unipolar Conduction in Electrolytes.—ISENBURG.—An account of some experiments made by him concerning conduction in only one direction. He electrolyzed a 1.5 per cent. solution of a mixture of sodium nitrate and carbonate with lead electrodes, and measured the various e.m.fs of the electrodes against an auxiliar cadmium electrode, and found that of the cathode remaining constant, while that of the anode increased; the e.m.f. of the cell increased in six hours from 1.6 to 30 volts. The e.m.f. of the polarization current increases from 1 volt to only 4 volts. The enormous rise of the e.m.f. of the cell is due, he believes, to the formation of a layer of a bad conductor on the anode. The behavior of an aluminum anode is similar and at the same time there is a condenser action.—*Zeit. f. Elektrochemie,* April 9.

Fixation of Atmospheric Nitrogen.—RASCH.—A summary of the theoretical and experimental work done in the fixation of nitrogen from the atmosphere by means of electricity. Instead of applying high-tension sparks, he proposes to use heat generators giving extremely high temperatures without being attacked themselves. This may be done by using solid electrolytic conductors (like the Nernst lamp filament) heated by Joulean heat, and he thinks that double the output can then be obtained, as compared with that of the electric spark. A still better means, he thinks, is to produce electric arc light discharges between solid or liquid electrolytes; such stable discharges can be obtained either in gases, or in vacuum, if the initial discharge is enforced by heating the electrodes or by spark-gaps; relatively low voltages (40 volts) are sufficient for this purpose. Arcs between incandescent electrolytes are said to give the highest temperatures which can be obtained at present.—*Dingler's Polyt. Jour.,* April 25.

REFERENCE.

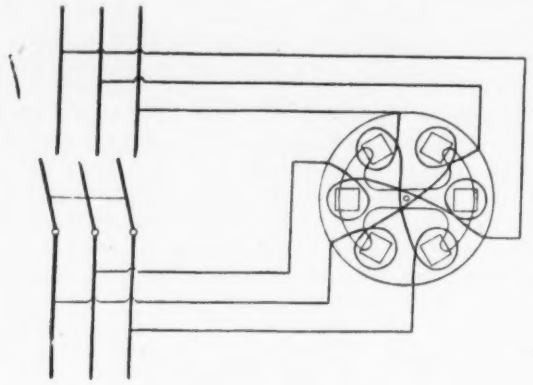
Ozone.—KAUSCH.—The first part of an illustrated article on the preparation of ozone by electricity. The original apparatus of Werner Siemens and the modern arrangements of Siemens & Halske are described.—*Elektrochem. Zeit.,* April.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring Small Capacities and Inductances.—FLEMING AND CLINTON.—A description of an apparatus "designed more from the point of view of an engineer than an electrical instrument maker," for measuring small capacities and inductances. This problem is important for Hertzian wave wireless telegraphy; the experimental determination of the electrical capacity of telegraph wires and of the overhead wires used for the conveyance of high-tension alternating currents, is also called for in connection with the calculation of sending speeds and of voltage drop in the line. For the measurement of small capacities when the dielectric is air or some other substance not possessing the quality of absorption, no method is so easy to apply as that depending upon the rapid charge and discharge of a condenser through a galvanometer. This method has been extensively used, the only difference being in the nature of the commutator for charging and discharging the condenser. Various types have been applied, but the present authors apply a new form of rotating commutator. A small 100 to 200-volt shunt-wound electric motor of ⅙ to ½ hp is bolted down upon a baseboard and has connected with it a starting and regulating resistance. To the shaft of this motor the commutating arrangement is connected by a flexible coupling; it gives four charges and four discharges in each revolution. This commutator is fixed on a shaft on which are held, by means of ebonite brushes and washers, three connected disks or wheels, of which the center one is shaped like an eight-pointed star, while the two outer ones are like crown wheels, each having four teeth. The three wheels are so set on the shaft that the teeth or projections of each of the two outer wheels interlock or fall in the space between the teeth of the other, while the radial teeth of the intermediate wheel occupy the intervals between the teeth of the two outer wheels. The whole outer surface is turned true and forms a barrel about 4 inches in diameter and 2½ inches wide. On this barrel rest three brass gauze brushes, the two outer ones resting on the continuous portions or flanges of the two outer wheels and the middle brush occupying the center line and making contact with either one or the other outer wheel or with the intermediate wheel. As the commutator runs round, the middle brush is alternately brought into metallic connection with first one and then the other of the two brushes on either side. The function of the middle wheel is to afford a stepping place and prevent and shock or jar when the middle brush passes over from one connection to the other; it also prevents the middle brush from short-circuiting the two outer brushes at any time. If one terminal of the galvanometer is connected to the brush pressing against one outer wheel, and one terminal of a battery is connected to the brush pressing against the other outer wheel, and one terminal of a condenser is connected to the middle brush, the other terminals of battery, galvanometer and condenser being connected together, then as the commutator runs round, the condenser is first charged by the battery and then discharged through the galvanometer. In their experiments they used a speed of 1,200 to 1,700 r.p.m.—*Phil. Mag.,* May.

Electric Devices for Comparing and Measuring Speeds.—BENISCHKE.—An illustrated paper read before the Berlin Electrical Society. When three-phase machines are connected in parallel, it is often desirable to see at once, whether the machine which is to be connected in parallel, runs at too high or too low a speed. Phase lamps and phase voltmeters indicate only whether sychhronism has been reached or how far the machines are from synchronism, but they do not show whether the speed of the machine to be connected to the others is too high or too low. An apparatus which indicates this was devised by Michalke; it consists of a series of three incandescent lamps, which are lighted in succession, either in one or in the opposite direction, according to whether the speed of the machine is too high or too low. The present author thinks that the observation of the lights is somewhat inconvenient, and has devised an apparatus by which the motion of a needle gives the indication. Its principle is that if both machines are in synchronism, the magnetic fields which are generated in the instrument, balance each other; if there is no synchronism, a resulting field is produced which rotates either in the one or the other direction. The instrument, as shown in the adjoining diagram, consists of six electromagnet cores, arranged in a circle and placed on a base wound of band iron. The windings of two opposite cores are in series, and the instrument is connected to the circuit and to the machine to be connected in parallel, in the way shown in the diagram. Over the poles of these electromagnets there is an iron sheet of the form of a double T, it is provided with a needle. The magnetic field revolves either in the one or the other direction and carries the iron sheet with it, which thus indicates whether the speed of the new machine is too high or too low. When the two machines have equal number of periods, the needle is at rest. Whether the proper synchronism with regard to the three phases is reached, is not indicated by this instrument, because the needle may be at rest also when the two machines are in opposite phase, but have equal numbers of periods. This instrument indicates only whether the number of periods in both machines

is exactly the same; the phase must be observed by means of a phase voltmeter or by phase lamps. In high-tension installations the instruments may be connected to the same step-down transformers to which the volt and ammeters are connected. He then briefly describes electric speed counters. The first type consists of a small direct-current dynamo with permanent magnet, together with a direct-current voltmeter which is directly calibrated in revolutions instead of volts. Such an instrument was used on one car during the high-speed railway tests at Zossen; the vibrations of the car did not change the permanent magnets of the instrument in the least. Another type of this instrument consists of a small single-phase alternating-current machine with permanent magnets, together with an alternating-current voltmeter. The length of the partitions of the scale follows approximately the law of squares, so that the scale has



COMPARING AND MEASURING SPEEDS.

more extended portions in those parts of the scale where the instrument is to be used. Another advantage is the absence of a commutator which in time may get dirty and cause small errors. He finally notices a theoretically interesting design; if a shunt machine is constantly excited and runs without load, a voltmeter connected to this machine can be calibrated directly in revolutions instead of volts, because the e.m.f. of the machine is directly proportional to the revolutions. If the machine is loaded the voltmeter no longer indicates the proper e.m.f. of the machine, but the e.m.f. at the terminals. In order to make the voltmeter indicate the e.m.f., a compensation for the ohmic loss in the machine must be applied; this is accomplished by introducing in the voltmeter a compensating winding through which a part of the armature current flows. If the magnetic field is constant, the number of the revolutions is directly proportional to the e.m.f. and the instrument can be directly calibrated in numbers of revolutionis. But in practice there is a continuous changing of the magnetic field, and the application of a compensation for such changes is very difficult, especially because in this case there is no proportionality and the characteristic curve of the machine must be taken into account. For each type of machine a special compensation winding must be calculated, and this is the reason why the use of such instruments is limited.—*Elek. Zeit.*, May 21.

Telegraphy, Telephony and Signals.

Remarks on Marconi's Ocean Telegraphy.—Koepsel.—An article giving conclusions drawn by the author from a description of Marconi's apparatus. He calculates that there must have been a wave length of 2,600 meters, which would demand a wire 600 meters long, in order to get good resonance. In reality the wire is only 90 meters long, and the author, therefore, concludes that a system of 400 parallel wires, as used by Marconi, is not as much for the purpose of increasing radiation into space, but is necessary in order to shorten the length of resonance, when such large capacities and wave lengths are used. The author gives the following explanation of the fact that the station on the Lizard, only 11 km distant, was not affected, while communication was maintained for over 1,600 km. If the latter sender system was very closely coupled and worked with an enormous wave length, while the receiver on the Lizard was very loosely coupled and tuned to perhaps one-tenth of that wave length, then there is no cause for wonder at this independence, because the first station sends out strongly damped long waves of great intensity, which naturally have as good as no action on the loosely coupled receiver, which works with considerably smaller wave lengths. The case would be different, if the wave length of both systems were interchanged, because the shorter sender usually disturbs the longer receiver. The author concludes that Marconi's system, to enlarge the wave length and to decrease the length of resonance of his air conductor by enlarging its capacity, has a practical limit, which is given by the relation of the capacity of the condenser circuit to that of the air conductor circuit. It is, therefore, not possible to send out unlimited amounts of energy into space, and Marconi might not be very far away from the limit, for if the capacity of his conductor system is estimated at 50,000, which is probably very near the truth, this comes close to the magnitude 900,000 of his condenser capacity, and the fall of tension cannot be disregarded any more.—*Dingler's Poly. Jour.*, May 23.

Miscellaneous.

Sheffield.—The first part of an account of a recent visit of a number of student members of the British Institute of Electrical Engineers to Sheffield. The Sheffield central station was started in 1886 and rebuilt in 1893; owing to the gradual development there is a great variety of different types of machinery installed in the present plant, but a new uniform plant is to be opened shortly. The power plant of the Sheffield tramway company has a normal capacity of 3,675 kw. Cooke & Co.'s works were also visited; the entire process of the manufacture of wrought iron from the crude pig was shown, also the manufacture of wire rods; the principal work of the firm is making ropes for mining purposes. They have tried electric welding for joining strands when necessary, but have abandoned this in favor of the older method, as the newer process has been found to make the joint more brittle and not so reliable for cables which are required to pass over pulleys.—*Eng'ing*, May 8.

German Electrical Industry.—Howe.—A brief article with a diagram giving curves which represent the variation of the stock quotations of seven of the largest German electrical manufacturing firms during the last six years. The maximum of the stock quotation was in all cases in 1898 and since that time the curves have dropped continually. Kummer is now at zero, and the Helios Company not far off, but even the curves of the large German companies show the same continuous dropping off. "The diagram is worthy of attention and shows only too plainly the terrible dangers arising from over-capitalization."—Lond. *Elec. Rev.*, May 1.

Copper Ores.—A note stating that there is evidence to show that in Northern Rodesia and in Central Africa there is an enormous wealth of copper ore awaiting only the advent of the railway to be made readily available for the purpose of consumers in Europe and elsewhere. It is believed that Africa will in a few years become the world's greatest source of supply. Some reports of Farrell are quoted. —*Eng'ing*, May 1.

New Books.

Telephone Lines. Methods of Construction, Overhead and Underground. By Walter C. Owens. London: Whittaker & Co. 390 pages, 265 illustrations. Price, 5 shillings.

In the preface to this further contribution to telephonic literature, the writer modestly remarks that he believes "this to be the first book that has ever been written, dealing exclusively, fairly and exhaustively with this subject." A casual examinatinn of the 380 pages of this volume reveals that the author must either have had a very limited acquaintance with scientific literature, or must have omitted to insert the adjective "English" prior to the phrase "first book," for the manuals of Miller, Kennelly, Hopkins, Dobbs, Webb and others in America, and Montilot, Weiller et Vivares and Bussac in France are not unknown, are fairly complete and apparently impartial.

There is, however, no denying that this presentation possesses some novelties and is thoroughly up to date from the somewhat insular and English point of view. The first half of the work is explanatory of aerial line construction and is noteworthy in giving details of iron poles in the use of which foreign engineers far excel American practice, but with this exception there is little that is novel. Then follows a short chapter on telephone circuits which is succeeded by a chapter upon aerial cables. Part II is devoted to underground construction; here but two forms of conduit are illustrated and little or no attention is devoted to the methods of conduit build-

ing. In conclusion there is a somewhat trite chapter upon electrical testing that merely recites old and well-known methods.

The volume is useful to the American telephonist in giving him quite a clear idea of the English point of view of the art, but excepting the data upon structural iron aerial construction the American telephone engineer has little to learn from it. The typography of the volume is good, but the cuts, and particularly those from half tones, are undeniably remote from the American standard of such work.

Directory of Electrical Societies, Etc.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York. General meeting, Niagara Falls, June 29, July 3.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Penington, 2020 State Street, Chicago. Next meeting, Saratoga Springs, N. Y., September 2, 3 and 4, 1903.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. ext meeting, Atlantic City, N. J., September 2, 3 and 4, 1903.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Annual convention, Detroit, Mich., July 14, 15 and 16. Frank J. Miner, chairman Exhibition Committee, 207 Jefferson Ave., Detroit.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, Ellicott Sq. Building, Buffalo, N. Y. Next meeting, Chicago, June 24 and 25.

Combination Railway and Lighting Storage Battery at Milwaukee.

The Milwaukee Electric Railway & Lighting Company has just completed the installation of a large storage battery plant at its central power station, which is notable as being the first large storage battery installation in this country, installed for use on both lighting and railway circuits. The Milwaukee Electric Railway & Light Company operates all the street railways in Milwaukee, and also all the electric light service. It has an Edison three-wire, direct-current network, for the downtown district.

The use of the same batteries for either railway or lighting involves a little more complication in switching, but has certain advantages in the way of affording a reserve for either railway or lighting plants. These advantages have already been demonstrated at Milwaukee, as there have been times when the ability to work the entire battery on the railway load has helped the railway part of the plants over a very tight place.

The battery is installed on the upper floor of the company's station on East Water Street, located on the east bank of the Milwaukee

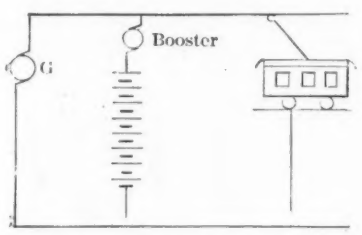


FIG. 1.—RAILWAY BATTERY.

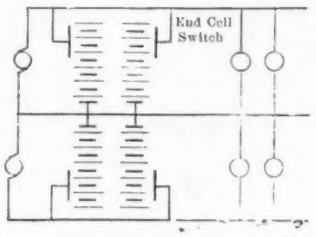


FIG. 2.—LIGHTING BATTERY.

River. This station was built several years ago, and provision was made for the storage battery at that time, but it is only recently that the battery has been installed. John I. Beggs, president and general manager of the Milwaukee Electric Railway & Light Company, foresaw the advantage and flexibility of a battery so connected as to be used on either railway or lighting circuits; and although this has not been the standard practice, he insisted that this company's batteries should be so arranged that they would afford a reserve to be connected to either the railway or lighting loads. As said before, the wisdom of this selection has already been demonstrated.

This battery, which was furnished and installed by the Electric Storage Battery Company, consists in all of 608 cells. These are grouped in various combinations, according to the uses to which they are being put. What will be designated as the railway battery in this article, because it is usually operated on the railway load, consists of 288 cells connected across the railway bus-bars in series, with a special booster, as seen in Fig. 1.

The battery ordinarily placed on the lighting load has its connections indicated in Fig. 2. In this battery there are 320 cells, divided into two series of 160 cells each. They are connected across the direct-current, three-wire incandescent lighting bus-bars. A switch by which some of the end cells can be connected in or out, is placed in each series of cells.

In case it is desired to connect both batteries to the railway load, switches are provided by which the arrangement shown in Fig. 3 can be obtained. Here the railway battery is connected between the

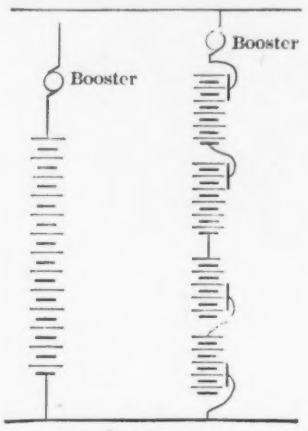


FIG. 3.—BOTH BATTERIES ON RAILWAY SYSTEM.

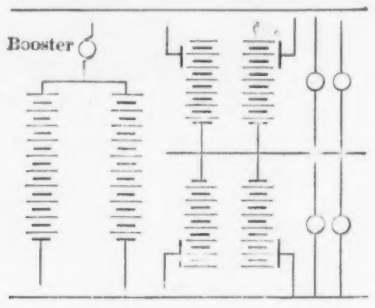


FIG. 4.—BOTH BATTERIES ON LIGHTING SYSTEM.

railway bus-bars just as in Fig. 1. The cells comprising the lighting battery have all been placed in series, and are connected through a second booster across the railway bus-bars. The voltage of the lighting battery is raised or lowered to correspond to that of the railway bus-bars by cutting in or out cells with the end-cell switches.

In case both railway and light batteries are to be connected on the lighting circuit, the arrangement shown in Fig. 4 is adopted. Here the lighting battery is connected, as in Fig. 2, and the railway battery has been divided into two sets, which are put in multiple with each other. These two sets charge or discharge on the lighting bars through the booster.

The arrangement is thus very flexible. The railway battery can be charged on the lighting bus-bars when the lighting generators would be otherwise idle, and can be put on to the railway load to help in summer traffic. In other words, the lighting generators can be made to help the railway generators without interfering with their usefulness on the lighting load. On the other hand, the railway generators might be made to help out the lighting load by charging batteries for use on the lighting circuits. The batteries act as a reserve to tide over emergencies in either railway or lighting departments.

The cells of both batteries consist of 39 plates in lead-lined tanks. The tanks are 41¼ in. wide, 20¾ in. long and 24½ in. high. The plates are 15½ x 15½ in. These cells have a capacity of 1,500 amp. for one hour, or 750 amp. for three hours. Since the railway battery consists of a single series, its capacity is 1,500 amp-hours for one hour, and that of the lighting battery, consisting of two series, is double this. The normal charging rate for the lighting battery is 750 amp., or 375 amp. per series. The end-cell regulating switches have 21 points, thereby permitting the cutting in or out of 21 cells. These switches are of 2,000-amp. capacity. The copper bus-bars from the end cells have a cross-section of ¾ sq. in. At the points where the bus-bars are taken off at the end of each series of cells, and also at each end cell, the capacity of the lead plate connectors on the cell is reinforced by a lead-covered copper bus-bar, which is connected to two points of the lead connector to which the battery plates are burned.

Figs. 5 and 6, which give an idea of the extent of the battery room, show this arrangement of bus-bars well. They also show the flexible suspension of the lead-covered bus-bars from the ceiling. This battery room is peculiar in being located over the generating room, and as one of the officers of the company put it, "We have a million pounds of batteries suspended from the roof." It is a fact

that the actual weight of the batteries, with bus-bars, is something over 1,000,000 lbs., as the weight of one cell alone is 1,626 lbs. The room is 71 x 98 ft.

The switchboard by which the various combinations of railway and

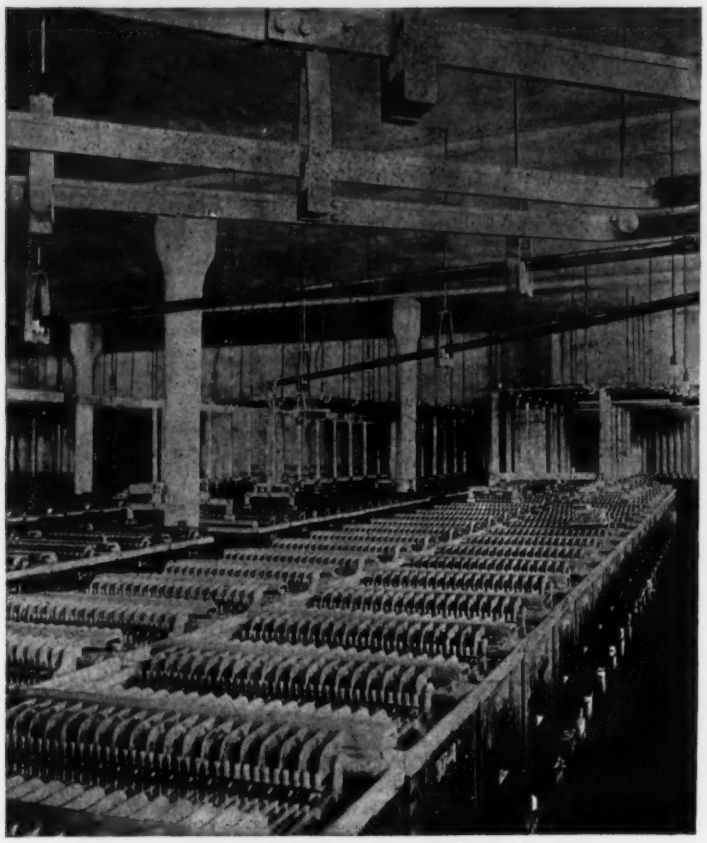


FIG. 5.—VIEW OF BATTERY ROOM.

lighting batteries can be made is shown in Fig. 7. It is located directly under the gallery containing the regular feeder board of the Edison three-wire network, as can be seen from the engraving. At the left is a panel containing the apparatus for controlling the four end-cell switches, circuit-breakers, are all of the I. T. E. laminated edgewise type. There is a circuit-breaker in the motor circuit of each booster, and this circuit-breaker is made inter-locking, with the circuit-breaker in the circuit of the booster armature. In case the motor circuit-breaker opens, the interlocking device causes the booster circuit to be opened also. This is to prevent the booster from running away and tearing itself to pieces, as it might if its circuit were kept closed with the motive power from the booster motor cut off. The circuit-breaker in the booster circuit does not, however, disturb the circuit-breaker of the motor driving the booster by

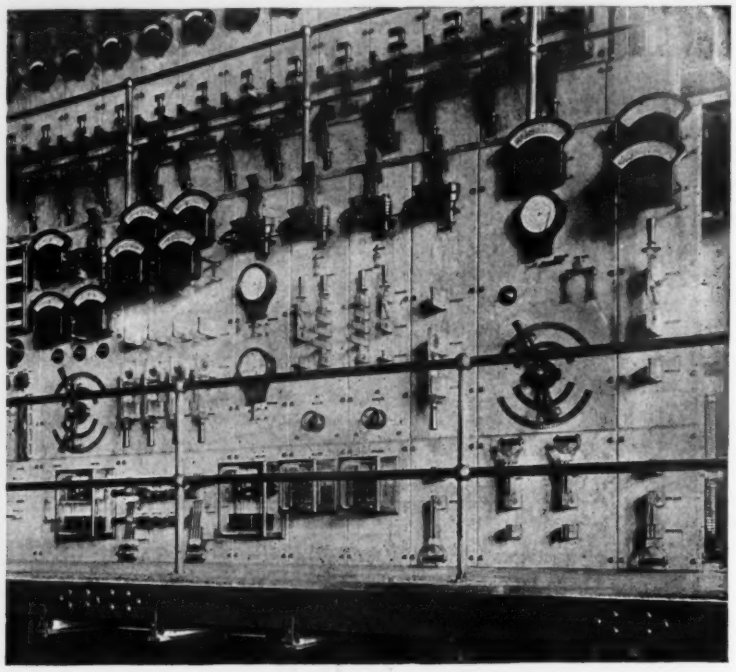


FIG. 7.—VIEW OF SWITCHBOARD.

its opening, as there is no reason why the booster should be stopped every time its circuit-breaker opens.

The boosters are shown in Fig. 8. They can be controlled so as to cause a battery to charge or discharge at any predetermined point,

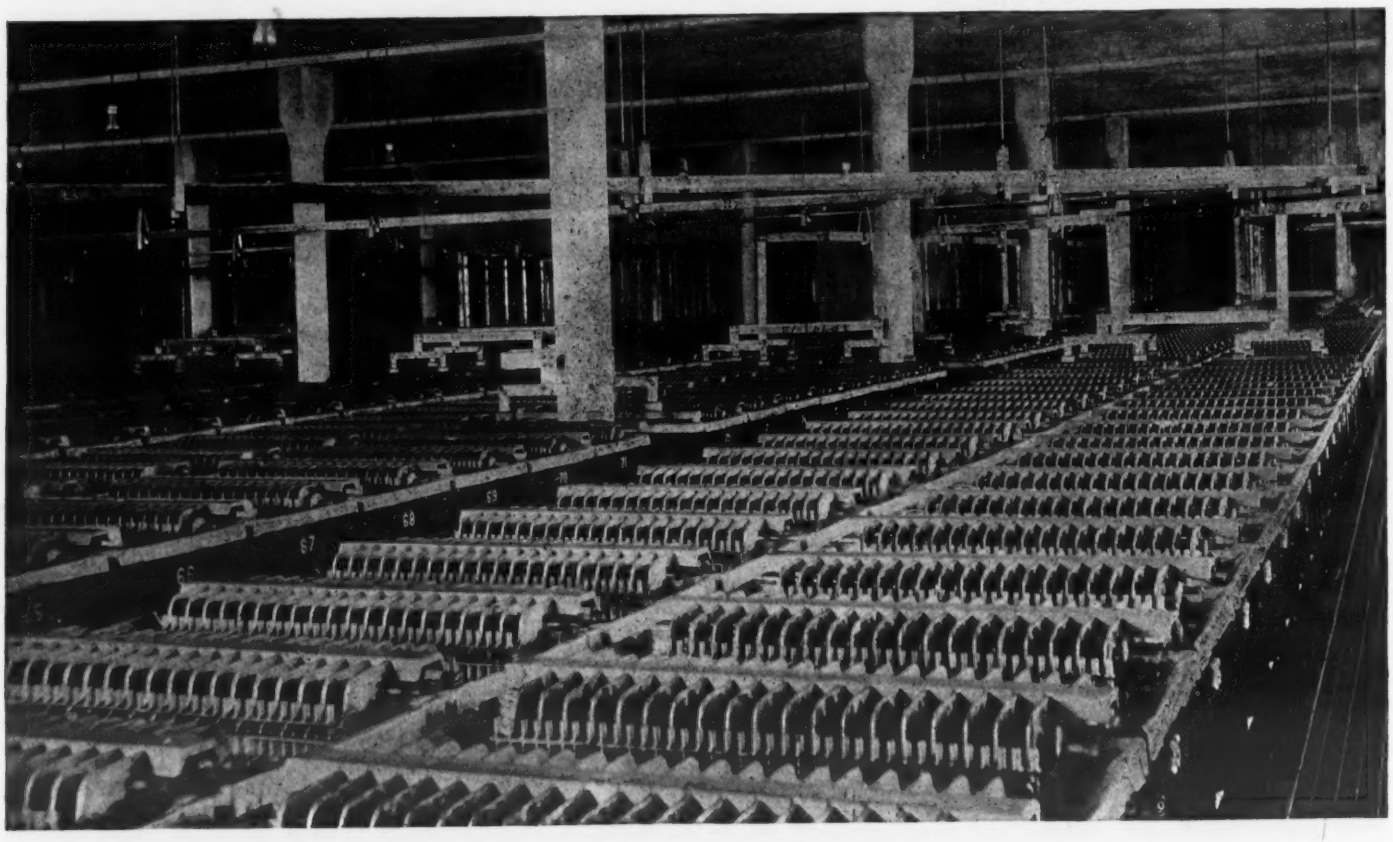


FIG. 6.—ANOTHER VIEW OF BATTERY ROOM.

by varying the strength of the shunt field, or if necessary, changing its direction. By using railway generators with very little compounding effect, the battery with the aid of the booster takes the fluctuation above or below a certain amount, which amount is determined by the adjustment of the shunt field of the booster.

The battery room was fitted up with great care to prevent any possible leakage of acids through the floor onto the ironwork, or onto the generating machinery below. On top of a layer of concrete, tar paper and pitch were spread, and over this a tile, burned extremely hard, was laid, with spaces between of ¼ in. Into this space was poured pitch even with the top of the tile. Sheet lead

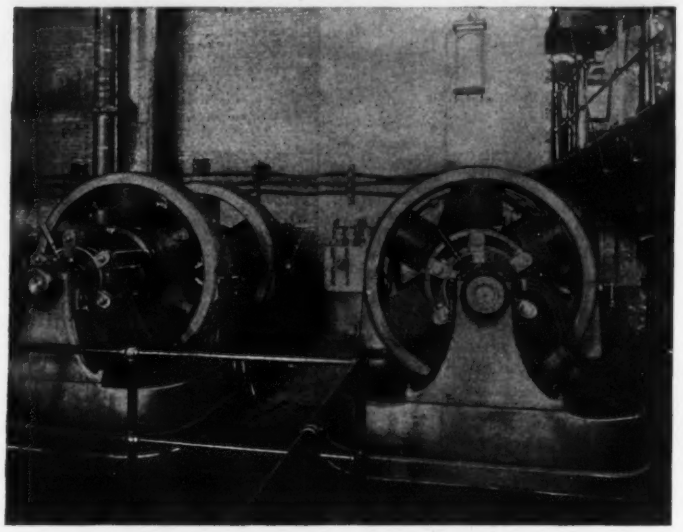


FIG. 8.—BOOSTERS.

was laid around the edges of the room to prevent acid getting through at the place where the floor joins the wall. This lead was carried up like a baseboard for a short distance above the floor. The same precautions were taken at the pillars. The whole interior of the room is coated with acid-proof cement.

New Line of Switchboards.

In most instances where small isolated electric plants have been installed for lighting one or two buildings, no standard lines have been followed, and consequently the switchboard had to be specially designed for the requirements of each case. No uniformity has prevailed, and the renewal of parts has caused great inconvenience. As a solution of this difficulty, the General Electric Company has recently placed upon the market a line of standard switchboards for small isolated lighting plants. The design includes a complete series of combination generator and feeder panels for direct-current service. Each of these panels is a separate and complete switchboard, and is not intended for combination with other panels. These small plant switchboards, within reasonable limits, the cost has been kept, are manufactured only for use on voltages of from 125 to 250 continuous current and only in capacities as specified in the appended list.

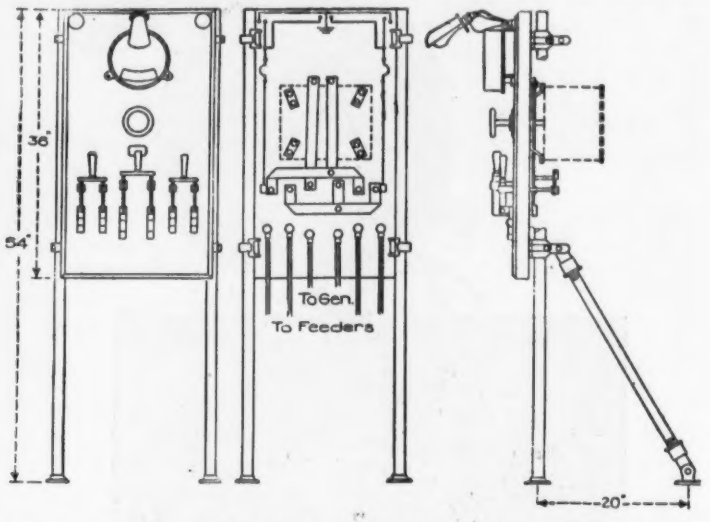
The switchboards provide for the generator and two feeder circuits, which arrangement provides for all ordinary classes of service. The material used in the construction of the boards is a fine variety of slate; the panels are hand finished to a perfectly smooth surface, after which several coats of lacquer are applied, thus producing a dull black, but extremely smooth surface. The slate is 1½ in. thick, has square corners and bevel front edges. The dimensions of the slate are 36 in. x 16 in. to 20 in., depending upon the capacity. All exposed metal parts on the front of the switchboard, except the live copper, have dull black finish.

The support of these panels consists of two one-inch gas pipes, each 64 in. long—the panels being fastened to the pipe by means of four cast-iron clamps, while the pipes are held in position by two cast-iron flanges, which are bolted to the floor by lag screws. Fastened to the center of each of these pipes is a tie rod which permits the panel to be supported from the wall, from the machine frame, or to stand in the center of the room. The tie-rods are provided with clevises, having a hinged joint, which will allow the flanges at the end to be bolted in a vertical, inclined or horizontal position.

The rheostats are not included with the standard switchboards. The panels are, however, supplied with four wrought-iron legs, which are so arranged as to support the standard rheostats used with the machine corresponding to the rating of each standard size of switchboard.

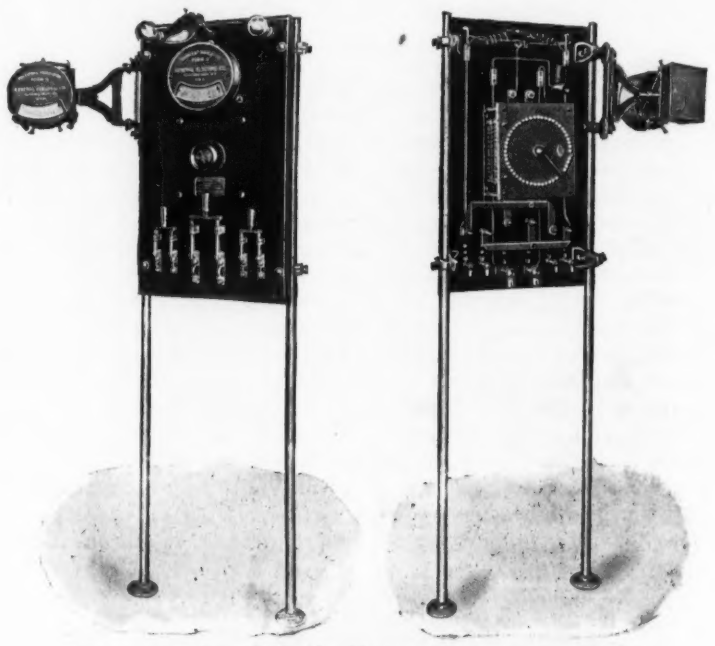
The switches used on all panels of this class are lever switches, having solid forged clip blocks and studs, the blades being rigidly fastened to the cross-bars. The blades, clips, clip blocks, and studs are of copper, and all the smooth surfaces have ground finish. Three complete sets of fuses are provided with all switches. Each feeder fuse has approximately 75 per cent. of the capacity of the generator fuse.

On all of these panels the current indicator is permanently con-



FIGS. 1, 2 AND 3.—FRONT AND REAR ELEVATIONS AND SECTIONAL VIEW OF SWITCHBOARD.

nected to the generator circuit. This current indicator is the General Electric Company's round pattern instrument, particularly adapted for long continuous hard service. Its few parts are strongly constructed, and having no spring it is free from any element likely to change. A potential indicator is not provided with these panels, since in some installations where they will be used, the illuminating lamp of the current indicator may serve sufficiently well as a pilot lamp. A potential indicator of the same type as the current indicator



FIGS. 4 AND 5.—FRONT AND REAR VIEWS OF SWITCHBOARD.

previously described, and provided with either a pivoted bracket supported at the top of the panel, or with a swinging bracket supported at the side of the panel, may, however, be applied and all panels are drilled for mounting these brackets.

The standard two-lamp ground detector is used on these panels; that is, one lamp is connected from each bus-bar to the ground, the voltage of the lamp always being the same as the voltage of the panel. A 16-cp lamp supported on a curved lamp bracket with a

half-round metal shade is included with each of these panels. When a panel is installed and later it is desired to have a pivoted potential indicator bracket mounted on top of the board, the lamp bracket is removed from the panel, which allows for the mounting of the pivoted bracket without any additional drilling of the panel; the lamp bracket may then be mounted on the pivoted bracket, which is so designed as to receive it.

FIG. 6.—GROUND DETECTOR.

The electrical connections of the various parts of the panel are shown in the accompanying cuts, Figs. 1, 2 and 3. All connections are made of bar copper, and terminals are provided for connections to the system. The switchboards are made for capacities ranging from ¾ to 20 kw, 125 volts, and from ¾ to 40 kw, 250 volts.

Novel Form of Cast Grid Rheostat.

An improvement in rheostats is noted in the appearance on the market of the cast grid type of the Stanley Electric Manufacturing Company, of Pittsfield, Mass. It is said to be the only rheostat in which the resistance units are directly connected to the contact studs. In other types, the units are connected to the studs by wires, a construction which necessitates soldered contacts, set screws, or a combination of the two. It is urged that the use of solder in a rheostat is highly objectionable, and, in practice, the set screws prove equally so, as they work loose and give rise to bad contacts. Moreover, short circuits sooner or later develop between the intercrossing wires as the insulation becomes impaired by the heat developed within the rheostat. The bulkiness of rheostats of the larger capacities has also, it is claimed, been an undesirable feature.

The S. K. C. rheostat consists of fifty to sixty iron grids radially arranged, as shown in the lower part of Fig. 2. This arrangement results in an exceedingly simple and compact mechanical construction.

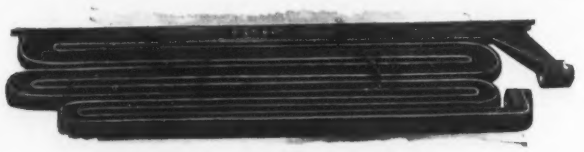


FIG. 1.—RESISTANCE UNIT.

Each unit, as shown in Fig. 1, is formed with a projection extending at such an angle from the plane of the unit proper as to permit direct connection with the next unit.

A contact stud passes through two adjoining units, furnishing electrical connection between them and supporting them in place, and, at the same time, supplying a contact surface for the contact arm. Each unit is thus firmly fastened by two studs or bolts to the substantial slate slab through which the studs pass. A corresponding slate

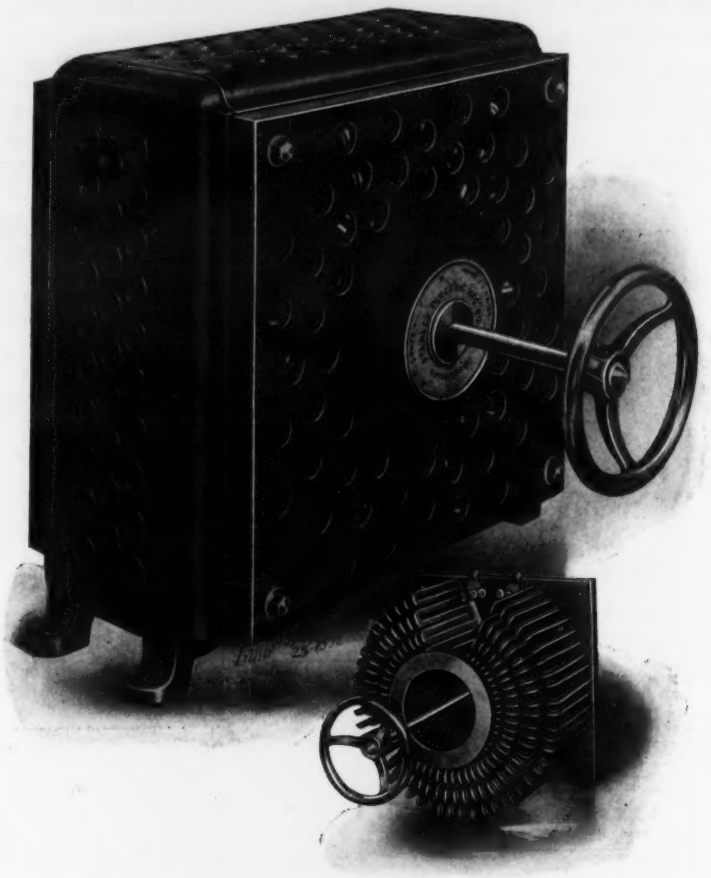


FIG. 2.—CAST GRID RHEOSTAT, SHOWING RADIAL ARRANGEMENT OF UNITS.

slab on the further side gives an additional support to the units, resulting in a very rigid outfit and one of pleasing symmetry. The

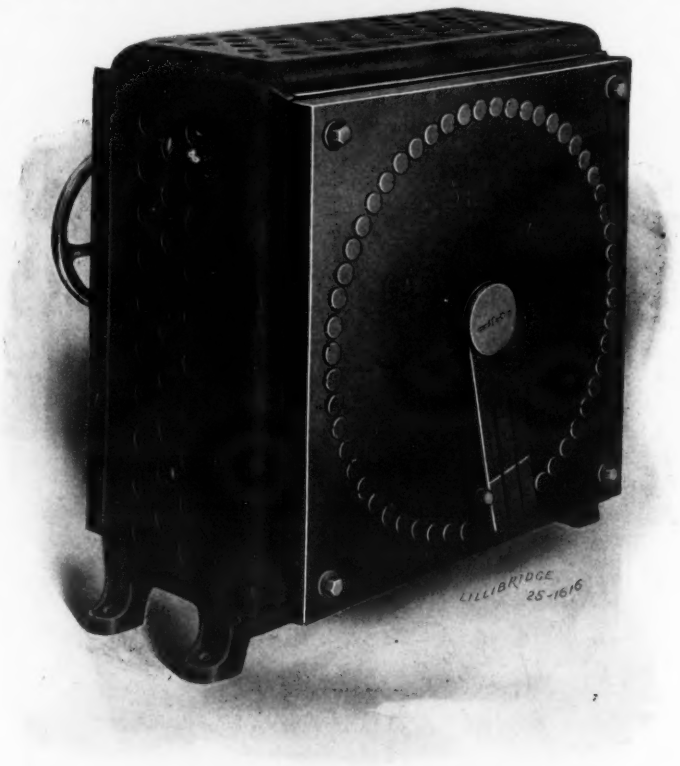


FIG. 3.—CAST GRID RHEOSTAT, CONTACT SIDE.

whole is mounted in a substantial and well ventilated iron case.

The resistance units are cast of such a shape as to furnish the best possible radiating and convective surface. The contact arm, as can be seen in Fig. 3, is unusually broad, giving a good contact surface and permitting the ready dissipation of heat.

"No Voltage Release" Up-to-Date.

The shunt field current of an electric motor of a certain horse-power and volts has always been an extremely indefinite quantity, and for many years past a comparison of the shunt field current in motors of various makes, having identical power and voltage, has shown that this variation in field current covers a range as great as 6 to 1. The tendency to-day is rapidly in the direction of a still wider range in the shunt field current, because modern practice in motor-driven tools and in every other line demands a wide range in the speed of the motor; and the simplest and one most efficient way to get such variations in speed is to vary the current in the shunt field circuit. The sparking troubles due to the armature reaction have been so overcome that it is no uncommon thing to find motors whose field currents are reduced to one-half, one-third and even one-fourth of their full strength in order to secure speed variations by imperceptible increments and with high efficiency.

It will be evident from what has preceded that the form of "no voltage" release in which the holding magnet is in series with the shunt field current may become unreliable and troublesome when the shunt field current varies in motors of different makes as much as 6 to 1, and, in addition, a speed control is used which increases the range some three or four times more. There are also more and more motors used having both a series and a shunt winding. This again introduces a further variation in the shunt field current, even if the horse-power, volts, speed and make be the same. It is evident that the holding magnet will give theoretically perfect results if it be connected so as to be dependent upon the counter e.m.f. of the motor only and independent of the field current or the armature current. Such a holding magnet will hold perfectly so long as the motor is producing the necessary protective counter volts and will automatically release whenever for any reason the counter e.m.f. falls below a properly protective amount. In addition, such a "no voltage" release is perfectly adapted for use upon any known kind of direct-current motor of a certain horse-power and volts, whether the motor be shunt-wound, series-wound, accumulative-compound, differential-compound, separately excited or magneto, and the current in the shunt-field winding or the series-field winding can be varied in any desirable manner for speed control without in any way affecting the perfect operation of the "no voltage release."

A patent on this counter e.m.f. "no voltage" release was issued to H. Ward Leonard June 29, 1897, but for many years it added so materially to the cost of starters and controllers as to make a material difference to the user. Inventions of Mr. Leonard in the past few years have, however, so reduced the cost of this form of "no voltage" that the counter e.m.f. form is now supplied whenever desired by the customer at the same price as the types dependent upon the shunt-field current and not really upon the voltage.

The advantage of this form of starter will be appreciated by every concern which has received orders for starters and has only the information that it is of so many horse-power on a circuit of known voltage, and consequently have not known whether the motor was shunt-wound, series-wound or compound-wound. This form of "no voltage" release has also many applications to other apparatus such as storage batteries, etc., and lends itself particularly well to various forms of push button control and distant automatic control, as the current through the magnet and the volts on its terminals are both so low that the magnet can be short-circuited or open-circuited with the most perfect, simple and reliable results.

It may be added that the improvement which has led up to the present encouraging state of affairs is based upon the production of an extremely high-resistance tube. By his new invention, Mr. Leonard is able to get 700 ohms on a square inch of surface, whereas with his enamel types used for field rheostats, theatre dimmers, etc., only about 30 ohms concentration to the square inch was feasible.

Irrigation in California.

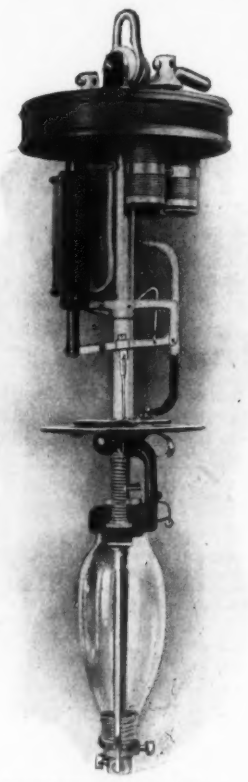
It is stated that irrigation by electrical power is to be tested practically on a large scale near Anderson, Shasta County, California. The Northern California Power Company, which has its headquarters in Redding, its power plant being in the Shingletown country, has just purchased the Bellevue tract, near Anderson, and is stringing wires from its sub-station in that village to its pumping plant on the Bellevue land. It has there set up a pump that has a capacity of 4,000 gallons a minute, the water to be lifted from the river. Hitherto there has been little or no irrigation of the fruit orchards about Anderson, because of the expense of constructing irrigation ditches or the expense of maintaining pumping plants operated by gasoline or steam. But electrical power is now so cheap that there can be no question of its ultimate adoption throughout the fruit belt. With plenty of water at the critical period of ripening, the productiveness of the orchards is increased 25 per cent., while without the water at that time one-quarter of the crop is lost. The value of fruit lands about Anderson has suddenly taken an upward bound in price as the electric power lines are being extended through the valley.

G. I. Enclosed Arc Lamp.

The General Incandescent Arc Light Company has made a number of improvements, noted below, in its enclosed arc lamp, with interchangeable parts, for 100 to 120-volt direct-current, constant-potential circuits.

The clutch is entirely insulated from the mechanism and therefore no current can sneak over the working joints of the clutch, clutch links, feed lever and dash-pot. The adjustable regulating resistance is mounted on several porcelain units, and is fastened by screws to a light circular casting, which is attached to the top casting of the lamp. These resistance units are connected by screw clamps, and the beginning and end leads are connected to the proper binding posts under the top casting. This form of resistance permits of the highest possible operating and maintenance economy. Damage occurring in any part of the resistance wire does not disable the entire coil, but only a quarter or sixth part is affected, and such damaged part or unit can be replaced by removing three screws and inserting a new interchangeable unit. The whole resistance can be removed from the lamp by unscrewing the two supporting and two clamping screws.

The adjustable resistance clamp is a much more important factor in a constant-potential lamp than is generally understood. A well-designed clamp must always make a good "elastic" contact with the wire, and it should preferably cover a considerable wire surface, so as to prevent the wire from rusting and also to preserve a perfect contact and allow the expansion and contraction of supporting porcelains under all possible conditions. A poorly designed adjustable contact will cause much trouble, allowing the arc adjustment of the lamp to change, due to increase of resistance in contact between the clamp and the wire.



ENCLOSED ARC LAMP.

It frequently happens, due to lack of appreciation of the importance of the above, that lamps are hung and allowed to operate year in and year out until the arc voltage gets so low that the lamp burns out or the customer complains. The increased resistance and excessive heating at the point of contact between the clamp and resistance wire will, moreover, cause the wire to get so brittle and weak that it is liable to break without warning. It is claimed that such troubles are practically impossible with the new style broad contact clamp by the General Illuminating Company.

The solenoid (or magnet coil) construction differs from the type used on previous lamps in that the coil is form-wound and is removable from the dash-pot tube. This improvement separates the dash-pot plunger with its tube from the magnet coil. In consequence of this change, the new magnet coil can be placed on the lamp without the dash-pot and graphite plunger. This form-wound magnet coil does not require brass heads or tube.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money hardened but was freely obtainable, the closing rates being 3½ per cent. for 60 days and 4 a 5 per cent. for 90 days to six months. The stock market was disturbed by a brokerage failure at Toronto, and suffered also from continued liquidation in Pennsylvania, Amalgamated Copper and other active stocks, the movement giving rise, in fact, to various disquieting but vague rumors. Other portions of the share list, however, exhibited a great deal of activity and participated in prevalent tendencies to an extent which made their action a matter of importance. The anthracite stocks were affected somewhat by the reports of the new danger of a strike in the anthracite region, but held better the latter part of the week. The traction shares were rather neglected, and no particular effect was produced by the fact that the July dividend on Manhattan was at the rate of 1½ per cent. for the quarter or 6 per cent. per annum. The explanation offered was that as a 7 per cent. rate is conditional upon the amount of the earnings for the full year, the extra 1 per cent. will not be declared until the termination of the first twelve months of the lease. The United States Steel stocks were active, with a tendency toward improvement in both common and preferred shares and the new 5 per cent. trust bonds. The quotations in the electrical and traction list, in most all cases, touched the lowest points of the year. Brooklyn Rapid Transit fluctuated between 60⅜ and 56⅜, closing at 57½, this being a loss of 1⅝ points. Metropolitan Street Railway closed at 127½—2 points below the highest figure of the week, and a net loss of ⅝. Manhattan closed at 136½, this being a net loss of ¾. The electrics were decidedly weak, and closed with a loss of several points in each case. General Electric fell to 175, but regained some of the loss, and closed at 177¼, being a drop of 3¾ points net. Westinghouse common lost 9 points, closing at 182. American Telegraph and Cable closed with a net loss of 3 points at 150, which was the lowest quotation of the week. Western Union was the only exception, and remained steady at 84, this being the closing quotation. Following are the closing quotations of June 9:

NEW YORK.

	June 2.	June 9		June 2	June 9
American Tel. & Cable	75	75	General Electric	180½	175
American Tel. & Tel.	..	140	Hudson River Tel.	..	..
American Dist. Tel	29	25	Metropolitan St. Ry.	128⅜	122¾
Brooklyn Rapid Transit	59¼	56¼	N. E. Elec. Veh. Trus.	⅛	..
Commercial Cable.	..	..	N. Y. & N. J. Tel.	..	..
Electric Boat	20	20	N. Y. E. V. T. Co.	5¾	5½
Electric Boat pfd.	38	38	Tel. & Tel. Co. Am	..	..
Electric Lead Reduction	1¼	1¼	Western Union Tel.	84⅛	83½
Electric Vehicle	8¼	6⅝	Westinghouse com.	..	178
Electric Vehicle pfd.	14½	12½	Westinghouse pfd.	185	175

BOSTON.

	June 2.	June 9		June 2.	June 9
American Tel. & Tel	145⅛	145¾	Western Tel. & Tel. pfd.	92*	91
Cumberland Telephone	..	..	Mexican Telephone	1¾	1¾
Edison Elec. Illum.	..	251	New England Telephone	132	133*
General Electric	255	175	Westinghouse	90	..
Western Tel. & Tel.	18*	13	Westinghouse pfd.	90	..

PHILADELPHIA.

	June 2.	June 9		June 2.	June 9
American Railways	..	..	Phila. Traction	86½	86½
Elec. Storage Battery	64½	63	Phila. Electric	6¼	6⅜
Elec. Storage Battery pfd.	..	..	Pa. Electric Vehicle	..	..
Elec. Co. of America.	8½	8¼	Pa. Electric Vehicle pfd	..	..

CHICAGO.

	June 2.	June 9		June 2.	June 9
Central Union Tel.	..	..	National Carbon pfd.	95	94
Chicago Edison	165	154	Northwest Elev. com.	..	..
Chicago City Ry.	200	190	Union Traction	4½	3½
Chicago Tel. Co.	140	135½	Union Traction pfd.	32½	30
National Carbon	23¾	23¾			

*Asked.

STREET RAILWAY INVESTMENTS.—The McGraw Publishing Company has just issued the tenth annual volume of the *Street Railway Journal's* publication, entitled "American Street Railway Investments," containing reports of 1,361 companies, showing in detail the physical and financial condition of the properties. Of this number nearly 1,300 reports are of an official character, the information being furnished by the railroad companies themselves. These figures include both operating and leased roads, and include data of all new roads. The figures are given for all important consolidations during the year. The reports of companies are arranged by States this year, instead of alphabetically by towns as heretofore. The book contains about twenty-five folding maps, some in colors, of the most important street railway systems in the United States. It also contains a table showing by comparisons the gross receipts of all companies earning $25,000 or more for the years 1901 and 1902. These figures are referred to in detail in an article appearing elsewhere in this issue.

LIGHTING MERGER IN PENNSYLVANIA.—The United Gas Improvement Company has acquired interest in gas and electric companies in Delaware, Montgomery and Chester counties, Pa., and will merge all the companies under the name of the Merion and Radnor Gas & Electric Company, with a capital of $1,000,000. Samuel T. Bodine, second vice-president of the United Gas Improvement Company, is to be president of the new company, which is to be subsidiary to the present corporation. The United Gas Improvement owns the gas and electric companies at Ardmore, Haverford, Bryn Mawr, Rosemont, Villanova, Wynnewood, Llanerich and Narberth. The other companies which are said to have been absorbed are the Lower Merion Gas Campany, Wayne Electric Light Company, People's Gas Company, of Delaware County; Radnor Township Light Company, Radnor Township Heat Company, Eastown Township Light Company, Eastown Township Heat Company, and Upper Merion, Haverford Township, Newton Township, Radnor Township, Eastown Township, Tredyffrin Township and Willistown Township Electric Light Companies.

DEAL AT URBANA, OHIO.—On June 1st the stock of the Urbana Electric Light and Power Company, of Urbana, Ohio, was sold to the Dayton, Springfield and Urbana Electric Railway Company. The plant thus becomes the property of, and will be controlled by, the Appleyard syndicate of Boston. It is the intention of the D. S. & U. Company to abandon the present lighting station, and to operate from the sub-station of the road now nearing completion at this point, the power to be transmitted from the company's central power house at Medway, near Dayton, at 26,000 volts. The organization was effected as follows: John S. Harshman, president; C. H. Ganson, vice-president; A. E. Appleyard, treasurer, and W. R. Pomerine, secretary. The above, together with Richard Emory, C. A. Alderman, George W. Hitt, John C. Powers and Frank E. Valentine constitute the new directorate. Mr. Valentine will be retained as manager.

COPPER STOCKS AND LOSSES.—It is stated that in the general decline in stocks, which has now extended over a period of three months, the copper shares of this city and Boston have suffered most severely. Twenty-four of the prominent copper companies whose shares are dealt in have lost in value $82,918,700 since the beginning of the year. Early in the year there was a boom in copper on account of the great improvement in the price of the metal. Copper advanced from 12 cents a pound to 15, and there has been no severe setback in the price of the metal since 15 cents was reached. Notwithstanding the maintained strength of the metal market, the shares of the various companies which are publicly traded in have sunk to low levels. Of the copper stocks, Amalgamated Copper has lost not less than $38,000,000 in market value.

DIVIDENDS.—The directors of the Commercial Cable Company have declared the regular quarterly dividend of 2 per cent., payable July 1. The directors of General Electric have declared the regular quarterly dividend of $2 on the common stock, payable July 15. The regular quarterly dividend of 1¾ per cent. on New York Metropolitan Street Railway is payable July 15. The directors of Detroit United Railway have declared the regular quarterly dividend of 1 per cent., payable July 1. The Boston Suburban Electric Company has declared a regular quarterly dividend of 1 per cent. on the preferred stock, payable July 15.

NEW WIRELESS COMPANY.—Information comes from Harrisburg, Pa., to the effect that Daniel Drawbaugh, the inventor, has virtually closed a deal whereby a syndicate, to be called the United States Wireless Signal Company, will acquire all his wireless inventions. It is said that he will receive $10,000 in cash and one-tenth interest in a $3,000,000 company recently organized to put the Drawbaugh wireless telegraph and telephone on the market. Mr. J. R. Stokes, of Philadelphia, is president of the company.

CHICAGO EDISON STOCK.—Stockholders of the Chicago Edison Company, at their annual meeting this week, authorized an increase in their capital stock from $10,000,000 to $15,000,000. It is not expected that any portion of the authorized issue will be put out before next year. There are two quarterly instalments of the $2,276,210 authorized at the beginning of the year to be paid in. The Board of Directors last November recommended the increase voted.

HAVANA TROLLEY FINANCES.—The stockholders of the Havana Electric Railway Company have given their approval of the proposition to issue $250,000 bonds out of the $2,500,000 of authorized consolidated mortgage bonds, for the purpose of construction, equipment, and improvement of lines of railway owned or to be owned by the company.

MONTEREY ELECTRIC TRACTION.—There is an extreme likelihood that notwithstanding the bankruptcy of the banking house of Sperry, Jones & Company, of Baltimore, Monterey will soon have an up-to-date electrical traction system, as New York parties are seeking to make financial arrangements for the acquisition of the existing horse-car lines and the Mackin & Dillon electric traction concession. The Sperry Jones people agreed to purchase the Companie Urbanos Ferrocarriles de Monterey—better known as the Empresa Company—of which Francisco Belden, of the Bank of London and Mexico, Monterey Branch, is president. The company operates a mule line thirteen miles in length. Thirty-three cars are employed. The franchise runs for sixty years, and permits of a six-cent fare. R. B. Sperry, acting on behalf of the Baltimore firm, agreed to pay $504,000 Mexican currency for the system. He also undertook to buy the Monterey & Santa Catalina railroad, better known as the Slayden lines, of which S. W. Slayden, 50 Broadway, is president. This is also a mule system. Its length is about fifteen miles. Twenty cars are in operation. The line runs to Topo Chico Springs, a popular summer resort in the vicinity of Monterey. The franchise runs for eighty years. The fare is six cents. Mr. Sperry, engaged on behalf of his firm to purchase the Slayden lines for about $150,000. The Mackin & Dillon concession, which is owned by the American contracting firm of that name, is for all the other streets of any value in Monterey not covered by the mule systems. There are about twenty-three miles in routes, including one to the huge plant just completed for the Monterey Iron and Steel Company. The franchise is for ninety-nine years. The concession permits of charging a fare of ten cents first-class and five cents second-class within the city limits. Mr. Sperry also agreed to purchase this franchise. Mackin & Dillon were promised ten per cent on the cost of electrifying the Empresa and Slayden system, and on the construction of the electric system for which they hold the concession. They were to secure the contract. It was also understood that $75,000 in bonds would be given them. These bonds were to be issued by the Monterey Street Railway Company, which was to be floated with a capital of $1,500,000 for the purpose of acquiring the existing lines and the Mackin & Dillon concession, and to build and operate the new system. Sperry, Jones & Company were unsuccessful in floating the company here, the parties approached considering the undertaking largely over capitalized. Three parties are now endeavoring to enlist capital to acquire the Monterey lines and to build an electric traction system. Mr. Blair, of the legal firm of Blair & Rudd, 32 Liberty Street, is seeking to interest British capital. Mr. Blair's firm acted for the Slayden people, and also for Mackin & Dillon, with a view to taking legal claim against Sperry, Jones & Company for breach of agreement. Mr. Blum, manager of the Federal Electric Company, 141 Broadway, is also trying to interest Britishers in the venture, while Mr. Mackin, of Mackin & Dillon, is bringing the project to the attention of Cleveland capitalists.

FEDERAL TELEPHONE.—At a special meeting of stockholders of the Federal Telephone Company, held at East Orange, N. J., June 2, it was voted to reduce the capital stock from $10,000,000 to $1,000,000, by the reduction of the par value from $100 to $10. A collateral trust bond issue of $6,000,000 was authorized.

Commercial Intelligence.

THE WEEK IN TRADE.—Weather and crop conditions were the uncertain features in the general trade situation. Heavy rains and consequent disastrous floods in the Southwest have caused much loss of life, property and crops, and trade and transportation in that section has been checked. Drought in New York and New England has hurt cereal crops, and forest fires have added to the damage from this source. In the Northwest the crop conditions are almost perfect, while in the South much impairment is still shown over last year. Cotton conditions are reported by the government to be the poorest on record at this date, but the predicted increase in acreage has materialized in a gain of nearly 4 per cent over last year. Prices for cereals are reflected in the damage inflicted on growing crops, and the principal ones are higher. The labor situation is still unsatisfactory, and it is reported that there are about 250,000 men still idle. Talk of a strike of anthracite coal men is not regarded seriously. Iron and steel prices tend lower. A settlement of the Amalgamated Association wage scale tends to give stability to this trade. In spite of the labor troubles, the demand for structural material remains surprisingly good. The railway gross earnings thus far reported for the month of May show a gain of 11 per cent. over last year, while April returns indicate profitable operation. Money is slowly hardening, but collections range from fair to good. The country's foreign trade promises well; failures are down to a low minimum, and bank clearings point to record totals outside of a few important speculative centers. The copper market is decidedly unsettled, producers holding firmly to their prices and consumers purchasing as sparingly as possible. Producers' official quotations are unchanged at 14¾ to 15c. for Lake and electrolytic, and 14½ to 14¾c. for casting stock. The business failures for the week ending June 4, according to *Bradstreet's* records, numbered 157, against 181 the week previous, and 153 the corresponding week of last year.

BELL AND KELLOGG INTERESTS.—Sensational developments have been made public the past week in Chicago in connection with the Kellogg Switchboard & Supply Company, of Chicago. The majority of the stock of this company was acquired some months ago, it seems, by Bell interests, a fact not known to the minority stockholders engaged in conducting the Kellogg business, until very recently. This controlling interest was originally held by Milo G. Kellogg. Mr. Kellogg went to California for his health, leaving all his affairs in the hands of an agent, with a blanket power of attorney. During his absence the stock was sold, and it is said that Mr. Kellogg has since been making the effort of his life to regain it quietly. Failing to do this by quiet means, the minority stockholders, including Messrs. Miller, Dunbar, Dommerque, Burlingame and Dean were informed, and a temporary injunction was secured by them preventing the majority stockholders from interfering with the operation of the company until the minority stockholders can get a hearing in court. The case is a most peculiar one in many ways and puts the minority stockholders, who have conducted the business, in a very embarrassing position, since a large amount of business has been secured by them recently on their personal assurances, backed by their personal convictions, that the Kellogg Company was not controlled by Bell interests.

LARGE MEXICAN HYDRAULIC PLANT.—Plans are now being prepared by Henry Ide Wiley, engineer of the mine, and W. W. Allen, consulting engineer, for the construction and equipment of a large water-power plant to operate the smelter which will ultimately have a capacity of 5,000 tons a day, and to drive the rock-drilling equipment and other machinery at Campo Santo mine, in the State of Sonora, Mexico, owned by the Yaqui Copper Company, offices, Broadway-Maiden Lane Building. The company is controlled largely by interests identical with those of the Greene Consolidated Copper Company. The Yaqui hydraulic plant will be the largest one hitherto employed to furnish power for mining operations. Power will be derived from the Yaqui river, which runs through the property. Owing to the large volume of water available, the working head will only be thirty feet. The initial capacity of the plant will be 1,000 hp. Four water wheels of 250-hp each, direct-connected to generators, will be purchased. Eventually the capacity of the plant will be increased to 5,000 hp.

EQUIPMENT OF ARIZONA SMELTER.—The Douglas, Arizona, copper smelting plant of the Copper Queen Consolidated Mining Company, 99 John Street, is to be operated by electricity. A 1,800-kw plant will be installed. There will be four 18 in. x 36 in. x 42 in. cross compound Corliss engines, direct connected to generators of 450-kw capacity each. The engines have been ordered from the C. & G. Cooper Company, Mount Vernon, Ohio, through that concern's New York offices in the Havemeyer Building, of which Mr. F. W. Idell is manager. The generators are to be of Fort Wayne make.

BALL ENGINE ORDERS.—The Tawas Sugar Company, East Tawas, Mich., will have an electric plant, consisting of two engines of 150 horse power, direct-connected to Crocker-Wheeler generators. The Ball Engine Company, Erie, Pa., furnishes the engines, which are of the self-oiling type. The Owosso Sugar Company, Owosso, Mich., will have an electric plant, consisting of two engines of 150 horse power, direct-connected to Crocker-Wheeler generators. The Ball Engine Company furnishes the engines, which are of the self-oiling type.

AFTER JAPANESE LIGHTING CONTRACT.—Frazar & Company, of Japan, 63-65 Wall Street, is figuring on a contract about to be awarded for the equipment of a Japanese lighting plant. The machinery includes a three-phase, 250-kw alternator for direct connection to a 350-hp vertical compound, condensing engine. The Frazar people have lately secured some fair-sized orders for electrical supplies for shipment to Japan.

NEW POWER PLANT FOR OMAHA.—A three million dollar power canal and electric power house will be built immediately on the Platte river, near Omaha, to furnish power to the South Omaha and Lincoln packing houses and street-cars. Work will begin immediately. New York capital is interested. Mr. W. J. C. Kenyon, manager of the stock yards, announces that details have been perfected and contracts will be made.

EQUIPMENT FOR CEMENT PLANT.—The Quaker Portland Cement Company's plant now under construction at Sandts Eddy, in the vicinity of Easton, Pa., is to be equipped with two 18-in. x 40-in. x 42-in. Cooper cross-compound, Corliss engines, to be direct-connected to Crocker-Wheeler generators of 400-kw capacity each.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, manufacturer of the Strowger automatic telephone equipment, reports an increasing demand for automatic telephone apparatus. It has recently sold to the Columbus Automatic Telephone Company, Columbus, Ga., complete equipment for a present installation of 700 lines, the switchboard to have an ultimate capacity of 3,000. Among other orders recently received by the company are the following: 100-station switchboard for the Mount Olive Telephone Company, Mount Olive, Ill.; 100-station switchboard to the Home Telephone Company, Birmingham, Ala., to be located in a branch exchange and work in connection with the larger exchange of that company in Birmingham; 100-station switchboard to the Vermillion County Telephone Company, Danville, Ill., to be located in a branch exchange, and to be connected with the exchange in Danville; 50-station switchboard to the United States Arsenal, Rock Island, Ill.; 40-station switchboard to the University of North Dakota, Grand Forks; 40-station switchboard to the Cape Railways Company, Cape Town, Africa; 150-station switchboard to A. J. Perkins & Son, Medford, Wis. The large exchange of six thousand stations which the Automatic Electric Company is building for the Dayton Home Telephone Company, of Dayton, Ohio, is rapidly nearing completion, and it will only be a few weeks before the citizens of Dayton will have automatic telephone service.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY, of Buffalo, will shortly open the Le Roy Telephone Company's exchange at Le Roy, N. Y. This exchange was built complete and all apparatus furnished by the Century Company. The equipment consists of two hundred line (present equipment) full common battery electric light line signal board, and double supervisory lamp signals. The power plant consists of storage batteries with the usual equipment of motor dynamos, switchboards and customary apparatus. This plant is one of the most complete and up-to-date telephone plants in the country. The Century Company has also just completed the plant for the Avon Telephone Company, Avon, N. Y. The outside construction is substantial, and the central office equipment consists of a visual target signal, common battery switchboard, with double supervisory visual target signals, one of the Century Company's latest productions. The power plant consists of the usual storage batteries, motor dynamos, switchboards, etc.

THE DAN RIVER POWER AND MANUFACTURING COMPANY will equip its cotton mill at Danville, Va., with electrical machinery throughout, and for this purpose has recently ordered from the Westinghouse Electric and Manufacturing Company two 750-kw and one 500-kw, 6,600-volt generators, together with two 125-kw exciters, each generator to be direct-connected to an independent water wheel. The current is to be transmitted three thousand feet to a step-down transformer station, in which will be located four 600-kw Westinghouse, oil and water-cooled transformers, which will step-down the 6,600 volts to approximately 500 volts. From these transformers the current will be carried to a sub-station switchboard, from which lines will run through underground vitrified conduit, to the various buildings where the current will be used for the numerous Westinghouse induction motors, which will drive the cotton mill machinery.

WESTINGHOUSE CORLISS ENGINES.—The extent of the large Corliss engine business, conducted by the Westinghouse Machine Company, through Westinghouse, Church, Kerr & Co., is well brought out by the fact that within the five years, during which the Westinghouse Machine Company has taken up the manufacture of large Corliss engines, a total of over 160,000 horse-power in engines has been sold, comprising four distinct types: vertical 3-cylinder compound, vertical cross compound, horizontal cross compound, and horizontal tandem compound. The equipments now in service include such plants as the New York Edison, Brooklyn Edison, Third Avenue Railway, New York, and Boston Elevated Railway. This record is particularly gratifying to the Westinghouse interests in that it represents but one branch of effort in the engine-building business, the Westinghouse Machine Company being also builder of the largest American gas engines and steam turbines.

A NEW GAS ENGINE CENTRAL STATION.—An interesting example of the application of gas engines to central station service is afforded by the new plant of the Franklin Electric Company, Franklin, Pa. The gas power equipment will supplant a large steam plant which the company has in operation at the present time, and will supply current, for electric light and power service throughout the city. The present equipment comprises five 125-hp Westinghouse vertical, 3-cylinder gas engines, which will be belted to a corresponding number of 75-kw alternating current generators. An interesting feature of the equipment is the provision made for the operation of the alternating-current generators in parallel. This has proven to be a very difficult matter up to the present time in gas engine practice. The plant operates upon natural gas fuel.

WESTINGHOUSE, CHURCH, KERR & CO., have recently sold additional train-lighting equipments to the Chicago, Milwaukee and St. Paul, and the Northern Pacific Railway Companies, for service on their special limited trains. The outfit consists of a 25 or 30-hp Westinghouse standard, vertical, single-acting engine, direct-connected to a direct-current generator of corresponding capacity. The units are extraordinarily compact, and are located in the front part of the baggage car, a location which is favorable for supplying high pressure steam directly from the locomotive boiler through flexible piping. The system is now in use on a large number of roads in this country, including the Chicago & Northwestern, Union Pacific, Lake Shore & Michigan Southern and Duluth, South Shore & Atlantic.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has recently closed another large contract for the installation of Chloride accumulators on the Pacific Coast. The Seattle Electric Company, which in April, 1903, closed a contract for the installation of a battery at the Fremont sub-station, for use in regulating the railway load, has now contracted for 154 cells, to be installed in the Post Street Station, at Seattle, to be used in connection with the lighting load. These elements will have a capacity of 14,400 amp. hours, and aside from caring for the peak, one of the most important features in connection with the installation is its value as a reserve. The containing tanks for this battery will be of sufficient size to allow an increase of 25 per cent. in capacity.

INGERSOLL-SERGEANT PLANT.—The Ingersoll-Sergeant Drill Company, Havemeyer Building, has just let contracts for considerable electrical equipment for its new plant at Phillipsburg, N. J. The Crocker-Wheeler Company has secured the contract for the generators and motors. The C. & G. Cooper Company will build the engines. There will be three direct-connected generators of 300-kw capacity each, and one of 100-kw capacity. There will be more than 100 motors, both grouped and individual. The engines will be of high duty, cross compound, Corliss type, to operate at 100 r.p.m. Three will be 14 in. x 36 in. x 36 in., and another will be of 9 in. x 22 in. x 30 in. dimensions.

AXLE LIGHTING EQUIPMENT FOR FOREIGN RAILROADS.—The Consolidated Railway Electric Lighting & Equipment Co., 100 Broadway, New York, recently secured a contract through the Japanese house of Mittsui & Company, New York offices 445 Broome Street, for several axle lighting equipments for use on Japanese railways. The specialties of the company are now being manufactured on a large scale in England. Vickers, Son & Maxim, the British representatives of the company, having erected an extensive plant in the vicinity of Birmingham for the purpose of turning out the equipments for British and Continental European railroads.

CREDIT MEN'S CONVENTION.—The convention of the National Association of Credit Men will be held in St. Louis June 9, 10 and 11, when questions affecting legislation and betterments for creditor and debtor will be discussed. The National association numbers about 5,000 members in thirty-four local associations, that of New York being the largest. Among the delegates who represent the New York branch are F. K. Dolbeer, Edison Manufacturing Company; A. P. Eckert, Electrical Trades Society; Charles E. Meek, National Lead Company.

THE BUFFALO STEAM PUMP COMPANY, whose works are at North Tonawanda, N. Y., has been purchased by Messrs. William F. and Henry W. Wendt, who are also owners of the Buffalo Forge Company and the Geo. L. Squier Manufacturing Company. The North Tonawanda Works of the Steam Pump Company are to be continued as heretofore, and the main offices will be in Buffalo.

HIGH SPEED JAPANESE TRACTION.—Frazar & Company, of Japan, 65 Wall Street, are figuring on behalf of American concerns on the contract about to be awarded for ten sets of four motor equipments, ten double trucks, etc., for use on a Japanese Electric road now under construction, on which the speed will be between 40-50 miles per hour. Each motor will be of 60-hp capacity.

ELECTRIC HOISTS FOR BROOKLYN DOCKS.—The Lidgerwood Manufacturing Company, 95 Liberty Street, New York, has just been awarded a contract for six hoisting engines for installation in the New York Dock Company's Brooklyn docks, where the equipment will be used for handling cargo. The hoists will be operated by G. E. motors of 25-hp each.

N. Y. SUBWAY SIGNALS.—The Union Switch and Signal Company, of Pittsburg, it is stated, has received a contract from the Interborough Rapid Transit Company to equip the subway in New York City with its signals in time for the operation of trains within a year.

ENLARGING LEWES, DEL., PLANT.—The Board of Public Works, of Lewes, Del., are enlarging their municipal plant. They will place a new engine and new dynamo in the power house, and will also extend their power and water mains.

General News.

THE TELEPHONE.

FLORENCE, ALA.—The Bell Telephone Company is installing a new system here at a cost of $9,000.

MONTGOMERY, ALA.—The Old Dominion Telegraph Company has been incorporated, with a capital stock of $10,000, by W. F. Dunn, E. R. Humphrey, J. J. Byron, W. F. Roberts and Thomas Young.

LITTLE ROCK, ARK.—The Southwestern Telegraph and Telephone Company, on May 26, opened a new long distance telephone connection with Memphis and points to the north and east in Arkansas. Its line extends north along the Iron Mountain Railroad to Hoxie, thence along the "Frisco" to Jonesboro, Sedgewick, Bonnerville, Nettleton, Marked Tree, Marion. Big Bay, Mosher, Culberthouse, Deckerville and Dague to Memphis. A branch line is being built to Paragould, giving connection with Piggott, Rector, Gamesville, St. Francis, Greenway and Bethel. Other lines are being built to Pocahontas, Black Rock and Powhatan.

SAN JOSE, CAL.—The fruit growers of Santa Clara County, it is stated, intend to establish a co-operative telephone system to connect their several farms.

SAN BERNARDINO, CAL.—Telephones are to be furnished for the trolley cars in Redlands, so that passengers can telephone, if they wish, while en route between Redlands and this place. Ten cars will be equipped with apparatus and there will be five stations between the two cities and one at each end of the road.

SAN FRANCISCO, CAL.—The Pacific States Telephone & Telegraph Company will rebuild its plant in this city during the next twelve months, and will thus expend about $1,500,000. It proposes to provide a capacity for 100,000 subscribers, the number at the present time being something over 40,000. The improvements will include new buildings or large additions for all the exchanges and new apparatus.

COLUMBUS, GA.—The City of Columbus will probably enforce an ordinance requiring the local telephone and electric light companies to place their wires underground.

DRIGGS, IDA.—A telephone line has been completed from here to Victor, and in the near future connection will be made with St. Anthony.

WATSEKA, ILL.—The Watseka Home Telephone Company has been incorporated by J. E. Bundey, J. A. Bundey and H. M. Fiske. The capital stock is $20,000.

LAWRENCEVILLE, ILL.—The Citizens Telephone Company, of Lawrence County, has filed a charter of incorporation. The capital stock is $25,000 and the incorporators are J. K. Dicherson, J. M. Spangler and C. W. Parkinson.

ANDERSON, IND.—The Orestes Telephone Company has been incorporated with a capital stock of $4,000.

INDIANAPOLIS, IND.—Sixteen new telephone companies were incorporated in this State during the month of May.

CONNERSVILLE, IND.—The Connersville Telephone Company has filed articles increasing its capital stock from $50,000 to $100,000.

LOGANSPORT, IND.—The Electrical Investment Company, of Ft. Wayne, which owns a half interest in the Logansport Telephone Exchange, announces an issue of $150,000 5 per cent. bonds to cover extensions and improvements in the Logansport system.

PLAINFIELD, IND.—The Plainfield Telephone Company has increased its capital stock from $25,000 to $100,000. This company and the Danville Telephone Company recently consolidated. Extensions and improvements will be made. Amos Carter is president.

FT. WAYNE, IND.—Financial concerns have been busy with new business propositions calling for investment money. The Home Telephone Company put on the market an issue of $50,000 bonds, 6 per cents, to cover cost of extensions in building a south side exchange and underground cables, and making other improvements to increase the capacity of the system so as to take care of the business offered.

INDIANAPOLIS, IND.—The Central Union Telephone Company will remove its general offices from Chicago to this city within a short time. The company has leased capacious quarters in the Majestic building and will establish therein the headquarters for Indiana, Illinois and Ohio. The company will bring 200 employees and employ an additional number by July 1. The supply department and shops will also be removed to Indianapolis as soon as an available site can be secured. The company has options on several sites now, and the location will be decided on within the next few days. The general officers and their families that will come to Indianapolis are: L. G. Richardson, president; Horace F. Hill, general manager; W. S. Chapman, secretary-treasurer; C. F. Hege, auditor, and J. C. Renney, purchasing agent. The movement is claimed to be for the bringing of the company into closer touch with the people of the three states and the improvement of the service in general.

EVANSVILLE, IND.—The announcement of four councilmen that fellow councilman Culbertson had attempted to bribe them to vote against the repeal ordinance relating to the franchise of the Cumberland Telephone Company which was passed some months ago has created a genuine sensation in this city. The Councilmen under oath testified that each of them were approached by Culbertson who said if they would vote against the ordinance to repeal the franchinse there would be $2,000 for each of them; that the money was deposited in the bank. The matter will be taken to the grand jury. Councilman Culbertson says the charge is false in every particular. The attorneys for the Cumberland Telephone Company say that Culbertson acted, if at all, without any authority from the Cumberland Company. City Attorney Funkhouser claims to have had knowledge of the attempted bribery for several months. He withheld his information until the eve of the trial to oust the company.

DEWITT, IA.—The Dewitt Telephone Company has increased its capital stock to $30,000.

CANISTOTA, IA.—The Canistota Telephone Company, with a capital stock of $2,000, is of recent incorporation.

SHENANDOAH, IA.—The Independent Mutual Telephone Company, of this place, has increased its capital stock from $50,000 to $100,000.

OTTUMWA, IA.—It is reported that the Bell Telephone Company has appropriated $75,000 for an exchange; for underground work and for other improvements in this city. The work will be carried out this year.

ELLIOT, ME.—The Elliot Telephone Company has been incorporated with a capital stock of $5,000 by George E. Hammond, John L. M. Oaks, E .Edward Bartlett, George O. Athome and Henry I. Durgin.

CITY OF MEXICO, MEXICO.—Pablo Martinez del Rio, representing the Mexican Telephone Company, has applied to the city council for an extension of time in which to put into effect its telephone service in this city.

ANN ARBOR, MICH.—The Washteneau Home Telephone Company has been incorporated with a capital stock of $250,000.

CAMBRIDGE, MICH.—The Cambridge & Woodstock Telephone Company has elected these officers: George Ebbert, president; S. Alderdyce, vice-president, and Clarence Neely secretary-treasurer.

WINDOM, MINN.—The Windom Mutual Telephone Company has been incorporated with a capital stock of $45,000.

MINNEAPOLIS, MINN.—The Twin City Telephone Company is planning to extend its lines into North Dakota and Wisconsin, as well as in Minnesota. This company was incorporated under the laws of Maine with a capital stock of $6,000,000.

HOLLY SPRINGS, MISS.—The Memphis Long Distance Telephone Company has accepted the franchise for a telephone exchange granted by the Council of this place.

HARWOOD, MO.—The Harwood Telephone Company has been incorporated with a capital stock of $50,000, by I. R. Dale, J. P. Davis, J. B. McCrary, T. V. Hayes, G. H. Wilson, Charles Steincross, J E. Underwood, and others.

RIVERTON, NEB.—The Riverton Telephone Company has been incorporated with a capital stock of $2,500.

GRAND ISLAND, NEB.—The Home Telephone Company, of this place, is of recent incorporation, its capital stock being $20,000.

LINCOLN, NEB.—The Western Union Independent Telephone Company has been incorporated with an authorized capital stock of $1,000,000. The company began business last March. The names of the incorporators are Charles J. Bills, A. W. Field and Frank H. Woods.

ALAMAGORDO, NEW MEX.—The Alamagordo Telephone Company is constructing a new telephone line from this place to El Paso, Texas. Homer M. Shofield, of Alamagordo, is general manager.

ROCHESTER, N. Y.—The Rochester Telephone Company will issue an additional $100,000 of accumulated preferred stock for the purpose of providing more switchboard capacity, additional telephones, underground cable and equipment.

MIDDLETOWN, N. Y.—The Orange County Telephone Company has awarded a contract to the Stromberg-Carlson Company, of Chicago and Rochester for the installation of a central-energy double supervisory multiple switchboard with an ultimate capacity of 1,600 drops.

YELLOW SPRINGS, OHIO.—The Miami Telephone Company has secured a franchise in this city.

CINCINNATI, OHIO.—The City & Suburban Telegraph Association (Bell) has purcahsed property at the corner of Race and Canal streets and proposes to erect one of the most modern telephone exchanges in the country. It is expected the entire outfit will cost about $500,000.

THOMAS, OKLA.—The Thomas Telephone Company has been incorporated with a capital stock of $10,000, by R. A. Smith, F. T. Crowley, J. E. and Oscar Zimmerman, of Lawson, Mo.; D. L. Kinzer, of Holt, Mo.; Jas. T. Riley, of Liberty, Mo., and O. F. Mitchell, of Thomas.

PHILADELPHIA, PA.—The Keystone Telephone Company's earnings for May show a handsome increase over those for April. The figures compare: May 3, gross, $38,480; increase, $3,664. Net, $18,174; increase $3,796. The Keystone is installing new telephones at the rate of about 500 a month, and by June 30 expects to have 10,000 installed.

DELL RAPIDS, S. D.—The Dell Rapids Farmers' and Merchants' Rural Telephone Company has been incorporated with a capital stock of $15,000. The names of the incorporators are M. R. Kenefick, O. F. Bowles, M. A. Dieson, H. O. Rime, O. O. Sawyer, L. K. Larson and Henry Robertson.

LYONS, TEX.—The Weiss Texas Telephone Company is preparing to build a line to Birch by way of Frenstat.

GONZALES, TEX.—The Gonzales Telephone Company is preparing to place its telephone cables underground on several streets of this place.

CHARLOTTESVILLE, VA.—The Albemarle Telephone Company has made arrangements with the Bell Company for long distance service.

RICHMOND, VA.—The Virginia Telephone Company, to operate in Amelia and other counties in Virginia, has been chartered with a capital stock of $10,000. R. H. Bruce is interested.

LEESBURG, VA.—The Leesburg & Point of Rocks Telephone & Telegraph Company has completed arrangements to connect its system with that of the Maryland Telephone & Telegraph Company.

LEVELS, W. VA.—The Levels Telephone Company has been incorporated to build a line from Southbranch to Romney via Levels. The capital stock of the company is $5,000. The incorporators are W. H. Harmon, D. M. Dickend, H. Rounells, Ed. Johnson and M. L. Snyder.

ELECTRIC LIGHT AND POWER.

CLAYTON, ALA.—Bids will be received until June 13 for $20,000 municipal electric light and water works bonds. J. J. Winn, Jr., is City Clerk.

GENEVA, ALA.—The town is about to petition the Legislature for permission to construct water works and an electric light plant.

MONTGOMERY, ALA.—It is stated that Alex. Rice and associates will construct an electric light plant, to supply commercial lights in the business district.

SALINAS, CAL.—The Salinas Water, Light & Power Company has 50 arc lights and 1,200 incandescents. Philo Jones is superintendent.

SANTA PAULA, CAL.—The Santa Paula Electric Company was organized in 1902 with $22,000 capital. C. C. Teague is secretary. It operates a General Electric system with 2,000 16-cp incandescent lights.

BENICIA, CAL.—The Solano Electric Light & Gas Company buys its power from the Bay Counties Power Company. It supplies 20 arcs and 3,000 16-cp incandescent lights, and power for five motors at ten cents per kw-hour.

GORE CANON, COLO.—The New Century Light & Power Company, formed in 1903, has $4,000,000 capital. R. G. Munn is president; R. L. Harper, secretary and treasurer. It is just beginning business.

SOUTH NORWALK, CONN.—The municipal plant here furnishes 106 street arcs and 20 others; 5,000 incandescent lights, 200-hp for motors at five cents per kw-hour and charges automobiles. This place offers splendid inducements for electrical industries, as there is cheap power, fine transportation, etc.

SOUTH NORWALK, CONN.—The contract for constructing an electric light plant here has been awarded to Bellman & Sanford, New York City, for $13,070. The works are now in the market for 110 series enclosed arc lamps for direct current street lighting, 5 amp., 70 to 75-volt; they also have for sale a complete arc dynamo-engine unit of 1,100-hp, two 60-light arc dynamos and 100 open arc series lamps.

DOUGLAS, GA.—The Douglas Ice & Power Company will install an electric light plant.

SPARKS, GA.—R. A. Knights, of Adel, Ga., contemplates installing an electric light plant at this place.

ATHENS, GA.—The Athens Electric Railway Company, capital $75,000, operates 47 arc lights and 7,000 incandescents.

WASHINGTON, GA.—This place has a municipal electric light plant. The city engineer, Mr. T. Ludlow, informs us that he holds options on water power suitable for electrical transmission and would like to hear from interested parties.

CALDWELL, IDA.—The Caldwell Power Company, formed in 1902, has about 1,200 incandescent lights.

BLOOMINGTON, ILL.—The Bloomington & Normal Railway Electric & Heating Company operates 150 arc lights and 6,000 16-cp incandescents.

GALVA, ILL.—The Chairman of the Lighting Commissioners has been instructed to correspond with electrical engineers in regard to preparing plans and specifications and superintending the construction of an electric light plant.

TAYLORVILLE, ILL.—The Taylorville Gas & Electric Company, of Taylorville, has been incorporated with a capital of $85,000. Incorporators: D. D. Shumway and Thos. R. Johns.

BREMEN, IND.—This town has a municipal plant supplying 25 arcs and 2,100 incandescent lights.

BLUFFTON, IND.—Robert S. Ashe, of Richmond, has secured the contract for the construction of an arc and incandescent lighting system for $31,748.

ROYAL CENTRE, IND.—The Royal Electric Light Company was organized in 1901 with $10,000 capital. W. G. Sweet is president. It operates 12 miles of circuit with 15 arcs and 600 16-cp incandescents.

WAUKON, IA.—The Waukon Electric Light Company has four arc lamps and 1,300 incandescents.

NEW ORLEANS, LA.—Bids will be received by V. Tajague, City Comptroller, for the construction of an electric lighting and power system for the city.

ORANGE, MASS.—The Orange Electric Light Company has 51 1,200-cp arc lights and 3,000 16-cp incandescents.

NEWTON, MASS.—The Newton & Watertown Gas Light Company has been bought by the Edison Illuminating Company of Boston. It operates 220 arc lights, 1,042 incandescents, 9 motors at 18 cents per kw-hour and charges automobiles.

NORWAY, MICH.—The City Lighting Department supplies 70 arc lamps of 1,500-cp and 3,500 incandescents of various candle powers.

GRAND RAPIDS, MICH.—The Edison Electric Company has, it is reported, been granted permission to construct a dam across Flat River in Vergennes Township.

CALEDONIA, MINN.—Bids will be received by Jerry Kenny, Village Recorder, for furnishing the following machinery, etc.: for an electric light plant: a 125-hp engine; 2 boilers, 80-hp each, and 2 dynamos, 400-kw each.

ST. CHARLES, MINN.—The citizens have voted to issue $10,000 bonds for an electric light plant.

CANTON, MISS.—The Canton Light & Water Works supplies 38 arc lights and 3,500 incandescents.

BUTTE, MONT.—The Phœnix Electric Company operates 150 arcs and 5,000 incandescent lights, with small motors of about 100-hp at 12½ cents per kw-hour.

BOZEMAN, MONT.—It is stated that bids are now being received for constructing an electric light plant for the People's Electric Light & Power Company, to be located at Gallatin Valley. The plant is to be operated by water power, and is to have a capacity of 75 arc and 3,000 16-cp incandescents. The estimated cost is $75,000. Address G. L. Hogan for further particulars.

LIBERTY, MO.—The Liberty Electric Light Company operates 28 2,000-cp arc lights and 1,400 16-cp incandescents.

MEMPHIS, MO.—The Memphis Electric Light, Heat & Power Company has been incorporated. The capital stock is $10,000. The incorporators are A. E. Platter, Elias Scofield, E. Brainard, Geo. W. Shacklett, W. B. McLane and others.

HEBRON, NEB.—The Hebron Light, Power & Heating Company has been incorporated with a capital of $12,000, by C. M. Wetherald, C. L. Richards and others.

WOODSVILLE, N. H.—The Woodsville Aqueduct Company has 2,000 incandescent lights.

BERLIN, N. H.—The Cascade Electric Light & Power Company has been making additions to its plant, and is running six electric cars on a flat rate basis.

DOVER, N. H.—The United Gas & Electric Company operates 600 arc and 20,000 incandescent lights and 300-hp in motors. It runs the Dover, Somersworth and Rochester Street Railway. A new station is being constructed with two 500-kw General Electric three-phase generators direct connected to a steam turbine. It will furnish power for the Dover, South Berwick & York Beach Railway.

YARDVILLE, N. J.—The Yardville Electric Light, Heat & Power Company is making arrangements to extend its system through Groveville.

ATLANTIC HIGHLANDS, N. J.—This place has a municipal plant which furnishes seventy-five 2,000-cp arc lights and 4,500 incandescents. Automobiles are also charged. There is great need of an electric railway.

HIGHLAND FALLS, N. Y.—The Buttermilk Falls Electric Company supplies 1,200 incandescent lights.

ITHACA, N. Y.—The Brush-Swan Electric Light Company, owned and operated by the Ithaca Street Railway Company, has 150 2,000-cp arc lights and 13,000 16-cp incandescents.

HUNTINGTON, N. Y.—The Light & Power Company was formed November, 1902, with $75,000 capital. R. de Forest is president and F. P. Willets, superintendent. The circuit will cover about 30 miles, but business has not been commenced yet.

CHATEAUGAY, N. Y.—The Chasm Power Company formed in 1892 has $20,000 stock and $2,000 bonds. C. S. Bentley, is president, W. B. Ryan, vice-president; A. B. Cooney, secretary, and H. S. Duffy, treasurer. The company expects to start lighting service this summer.

ROCHESTER, N. Y.—The following contracts have been awarded for electric work in the Rochester State Hospital. Engines, generators, etc., to the Fred. Fish Company, Rochester, for $5,466, to include Watertown engines and Thompson-Ryan dynamos; switchboard, electric light wiring and fixtures to F. L. Frost, of Albany, $8,775, and telephone and watchman's clock systems, to McDonnell & Dumond, Rochester, at $1,292.

BISCOE, N. C.—The Biscoe electric light plant is owned and managed by R. L. Chandler. It has 200 16-cp incandescent lights.

HICKORY, N. C.—The Thornton Light & Power Company, organized in 1903, has $50,000 capital stock. M. E. Thornton, president and manager, informs us that he is the owner of good water power and is largely increasing his incandescent circuit. He operates 19 arcs of 3,000-cp and 384 16-13-32-cp incandescent lights.

WELLSTON, OHIO.—This place has a municipal plant operating 100 arc lights and 4,000 incandescents.

STRASBURG, OHIO.—The Strasburg Electric Company operates 10 arcs and 500 incandescent lights.

FT. RECOVERY, OHIO.—The Municipal Light & Water Works has 28 arc and about 500 incandescent lights.

BELLAIRE, OHIO.—The Bellaire Light & Power Company supplies 150 arcs and 8,000 incandescent lights.

BARNESVILLE, OHIO.—The Gas & Electric Light Company has about 34 arc lights and 78 50-cp street incandescents.

NEW BREMEN, OHIO.—The village authorities are planning to purchase the local lighting system now owned by private parties.

JEFFERSON, OHIO.—The Jefferson Light & Power Company operates 2,000 incandescent lights. The company's office is at Warren, Ohio.

BLOOMDALE, OHIO.—The Bloomdale Electric Light Company operates 10 arc and 700 incandescent lights. It wants a 50 to 60-hp engine.

NORTH BALTIMORE, OHIO.—The North Baltimore Electric Light & Power Company has 20 miles of circuit, 75 arcs and 2,700 incandescent lights.

BELLEVUE, OHIO.—The Bellevue Light & Power Company shows an increase in electric lighting, having now 30 200-cp arc lights and 3,000 incandescents.

AKRON, OHIO.—City officials are considering installing a lighting plant in the new City Hall. F. F. Loomis, mechanical engineer for the city, will design the plant.

CHILLICOTHE, OHIO.—Mr. J. S. Dailey is the proprietor of the Electric Light & Water Works, establilshed in 1891. He operates 92 electric light contracts and 279 telephones.

LISBON, OHIO.—The New Lisbon Gas Company supplies fifty 1,200-cp and fifteen 2,000-cp arc lights and 800 incandescents. An electric railway across the country is badly needed.

DELPHOS, OHIO.—The Delphos Electric Light & Power Company has just completed the reconstruction of its plant. It supplies 75 street enclosed arcs and 5,000 incandescent lights.

MARTIN'S FERRY, OHIO.—The municipal electric light plant operates 110 2,000-cp open arcs, but contemplates adopting enclosed arcs. There are also 3,500 16-cp incandescents.

ADA, OHIO.—The Ada Water, Heat & Light Company, formed in 1901 with $75,000 capital, has 12 miles of circuit and 60 arc lights. C. S. Ames is president. There is an opportunity for an interurban railway.

XENIA, OHIO.—The People's Gas & Electric Light Company was organized in 1902 with $175,000 capital. J. H. Brown is president. It has 147 arc lights, 5,000 incandescents and 30 motors at five cents to ten cents per kw-hour.

ALLIANCE, OHIO.—The Alliance Gas & Electric Company has made great improvements in its plant this year, having put in General Electric machines and Hartford transformers, giving a first-class system. There are 125 arcs and 5,000 incandescents, besides a few small motors.

FINDLAY, OHIO.—J. M. Barr, of Findlay, and W. V. Coons, of Cleveland, are organizing a company for the purpose of securing the local lighting contract and erecting a lighting system. The present contract is held by the Toledo, Bowling Green & Southern Traction Company.

McCONNELLSVILLE, OHIO.—The McConnellsville-Malta Electric Company derives its power from a dam in the river. The normal head is 10 feet, but at times it is reduced to three, hence the necessity for engine and greater turbine power. It operates 52 street arcs and 900 incandscent lights.

COLUMBUS, OHIO.—The Columbus municipal electric light plant installed in 1898, has $68,000 bonds. It has 50 miles of wire and operates 320 arc lights. It is now installing a plant with 1,500 alternating enclosed arcs, the station being operated by Westinghouse turbines. P. Okey is superintendent.

WARREN, OHIO.—The Warren Electric Light & Power Company furnishes 238 arcs of various kinds and 6,000 incandescent lights and power for 40 motors. The rates for power by meter on the 500-volt circuit are as follows: Less than 200-kw per month four cents per kilowatt; more than 200-kw and less than 375-kw, 3¾ cents per kilowatt; more than 375-kw and less than 750-kw, 3½ cents per kilowatt; more than 750-kw and less than 1,865-kw, 3 cents per kilowatt; more than 1,865-kw per month, 2¾ cents per kilowatt.

PUT-IN-BAY, OHIO.—Russel K. Ramsey, of Sandusky, is stated to have secured a franchise for the construction of an electric light plant for Put-in-Bay.

GUTHRIE, OKLA.—The New Electric & Gas Light Company has $50,000 capital stock. E. Cook is president. It operates 50 arc lights and 3,706 16-cp incandescents, also electric fans at flat rates.

SUMPTER, ORE.—The Sumpter Light & Power Company has 20 arc lamps and 1,800 incandescents.

EUGENE, ORE.—The Lane County Electric Company has sold out to a large company, which is now putting in a transmission plant and perfecting the plant.

SUMPTER, ORE.—It is reported that all the plans of the Great Eastern Power & Light Company have been completed, and that preliminary work will commence immediately. The first electrical plant to be installed will be on John Day River, at the head of John Day Valley, and will generate 6,000-hp, which will be utilized immediately. The company has water power rights capable of generating 23,000-hp. To utilize this power will involve the erection of plants at three separate points.

TROY, PA.—The Troy electric light plant is not now in operation, but a new one is in contemplation.

LYKENS, PA.—The Williams Valley Light & Power Company operates three arcs and 3,900 incandescent lights.

AVOCA, PA.—The Standard Electric Light Company operates 177 enclosed arcs and 6,000 incandescents. General supplies are needed.

ST. CLAIR, PA.—This is a municipal plant under the management of J. W. Reese. It operates 58 arcs and 2,579 incandescent lights.

JERMYN, PA.—It is proposed to construct an electric light plant here to cost from $12,000 to $15,000. C. F. Baker and C. A. Battenberg are interested.

MASONTOWN, PA.—It is proposed to construct an electric light plant here to cost from $12,000 to $15,000. C. F. Baker and C. A. Battenberg are interested.

MOUNT HOLLY SPRINGS, PA.—The Mount Holly Paper Company has two electric light plants in its mills and furnishes free light for the town, churches and public library.

DANVILLE, PA.—The Standard Electric Light Company shows quite an increase in the number of lights, having 120 2,000-cp. arc lights and 1400 incandescents.

WEST CHESTER, PA.—The Edison Electric Illuminating Company operates 250 enclosed arcs, 7,000 16-cp incandescent lights, and 30 motors at three to eight cents per kw-hour. It also runs four cars.

HARRISBURG, PA.—The Harrisburg Light, Heat & Power Company has secured the contract for lighting the city for five years at $47 per 2,000-cp arc light per year. The Paxtang Electric Company bid $49.50 a year for five-year contract, and the United Electric Company $64 per year for five years.

ABERDEEN, S. D.—The Aberdeen Gas Company runs an arc circuit and supplies 19 lamps.

MADISON, S. D.—Mr. Rac, of the municipal light plants, informs us that they are asking for bids on a 125-hp boiler, 125-hp engine direct connected to a 110-kw machine of same size.

DEADWOOD, S. D.—The Cascade Water Power & Electric Transmission Company owns claims along the Spearfish River for which about 4,500-hp will be developed at no distant date. Mr. R. N. Ogden is the president.

COVINGTON, TENN.—The corporation purchased the electric light plant this year from Mr. J. Craig. It supplies 1,600 incandescent lights.

SPRINGFIELD, TENN.—The Ice, Light & Laundry Company supplies 15 arc and 500 incandescent lights. There is some question of the municipality erecting a plant of its own.

CHATTANOOGA, TENN.—Samuel Jenkins, of Chattanooga, is reported organizing a company, with a capital of $500,000, to build an electric power plant for operating street railway, lighting the city and furnishing manufacturing enterprises with power, etc.

MADISONVILLE, TEX.—A. S. & H. J. Allen will soon begin the construction of an electric light plant at this place.

MT. PLEASANT, TEX.—Mt. Pleasant Electric Company, organized in 1903 with $10,000 capital, has 9 arc and 900 incandescent lights.

CLEBURNE, TEX.—The Cleburne Light & Power Company runs motors, the charges for which are from 15 cents to 8 cents per kw-hour. A gas plant is to be installed.

NACOGDOCHES, TEX.—The Nacogdoches Light & Power Company, organized in 1902, is just about putting in a new boiler. It operates 1,250 incandescent lights, also about 100 fans.

EAGLE PASS, TEX.—The Texas-Mexican Electric Light & Power Company. P. De Bona, president, would like to receive bids on one 37½-kw 16,000 alternations, 1,040 volt alternator and one 75 and one 100-kw, 16,000 alternations, 1,040 volts.

HOUSTON, TEX.—The Houston Lighting & Power Company, organized in 1902, has $750,000 capital and $750,000 bonds. W. H. Chapman is general manager. The city is supplied with 433 street and 400 commercial arcs, and there are 16,000 incandescent lights. The rates for motor power are 6 cents per kw-hour up to 20-hp and 5 cents per kw-hour over 20-hp.

PAYSON, UTAH.—The electric light plant (municipal) requires one 100-kw 5,000 volt 60-cycle exciter and switchboard complete; also 150-hp Corliss engine and boilers all complete.

WARRENTON, VA.—The Warrenton Electric Company, organized in 1901 with $25,000 capital, has 28 arc lamps and 800 incandescents. We are informed that there is an opening for an electric light and power plant at Culpepper on the main line of the Southern R. R.

TEKOA, WASH.—The Mahoney Electric & Plumbing Company, Mahoney Bros., proprietors, operates 15 arc and 650 incandescent lights. The company is in need of transformers.

OLYMPIA, WASH.—The Olympia Light & Power Company has $165,000 capital, operates 50 arc lights, 300 incandescents, about 15 motors, at from two cents to seven cents, and a few street cars.

BALLARD, WASH.—The Ballard Electric Company just organized, has $150,000 capital stock and $50,000 bonds. W. G. Clark is president. It has 1,000 16-cp incandescent lights and expects to increase its capacity within the year.

ANACORTES, WASH.—The Anacortes Water Company, formed in 1892, was re-organized in 1901, when an electric plant was added. The capital stock is $100,000. Douglass Allmond is president. There are 12 arcs and 14 incandescent lights.

TACOMA, WASH.—The Syndicate Heat & Power Company is owned by five owners of five office buildings for furnishing light, heat and elevator service. There is a good opening for another car line with plenty of water power for a generating plant.

WHEELING, W. VA.—The Wheeling Electric Company operates 259 arc and 21,000 incandescent lights.

WELCH, W. VA.—The Welch Water, Light & Power Company proposes during the coming summer to double the capacity of its electric light plant by the addition of new boilers, engines and generators. The company will issue about $25,000 bonds to cover the above and other improvements. D. J. Howell is manager and treasurer, 605 12th St., N. W., Washington, D. C.

CASHTON, WIS.—The Cashton Milling Company has two arc and 700 incandescent lights.

WAUPUN, WIS.—The municipal plant furnishes forty-six 1,200-cp arc lights and 3,500 16-cp incandescents.

PRINCETON, WIS.—The Citizens' Electric Light & Power Company has $7,500 capital and supplies 20 arc lights and 1,000 incandescents.

GRANTSBURG, WIS.—Bids are now being received for erecting a village electric light plant, cost not to exceed $8,000. Oscar Clausen, St. Paul, Minn., is engineer.

WAUKESHA, WIS.—The Waukesha Gas & Electric Company, of Waukesha, has been incorporated, capital $100,000. Incorporators: T. W. Haight, H. M. Buck and F. H. Putney.

WAUPACA, WIS.—The Waupaca Light & Railway Company is just putting in new rope transmission at a cost of $1,800. Besides running several cars it supplies forty-seven 2,000-cp arcs and 1,500 incandescent lights. I. P. Lord is manager.

SUPERIOR, WIS.—The Great Northern Railway Company has completed its electric lighting plant at Allouez, and the immense ore docks are now lighted at night with 130 arc lamps. The new plant has a capacity for about 200 lamps. The new system cost about $35,000.

ROCK SPRINGS, WYO.—The plant of the Union Pacific Coal Company, of Omaha, Neb., is situated at this place. It operates a General Electric system and has twenty-seven arc and 2,000 incandescent lights .

ENCAMPMENT, WYO.—The Emerson Electric Light Company, T. C. Dobbins, superintendent, uses the General Electric system and furnishes fifteen 2,000-cp arc lights, 650 incandescents, and operates fourteen electric motors.

SARATOGA, WYO.—The Saratoga Light, Heat & Power Company was incorporated in 1902 with $25,000 capital. It employs a General Electric alternating system, has 7 arcs and 700 16-cp incandescent lights. W. J. Barker is general manager.

THE ELECTRIC RAILWAY.

MOBILE, ALA.—The Mobile Light & Railroad Company is running 75 motor cars and 25 trailers.

MARTINEZ, CAL.—An application has been filed by Robert N. Frick for an electric railway franchise to the top of Mt. Diablo. The proposed line is to pass through various towns between Martinez and Mt. Diablo.

LOS ANGELES, CAL.—The Los Angeles & Glendale Electric Railway Company has been incorporated, with a capital stock of $1,000,000. The directors are R. H. Howell, E. T. Simpson, W. H. Holliday, George F. Cope and L. C. Brand.

WINDSOR, CONN.—The Rockville, Broad Brook & East Windsor Street Railway Company has organized as follows: Frank Grant, of Rockville, president; H. C. Wells, of East Windsor, vice-president; C. E. Harwood, of Rockville, secretary and treasurer. This company is capitalized at $100,000.

WALLINGFORD, CONN.—The Wallingford Tramway Company, which was recently incorporated to build a street railway between this city and New Haven, has begun surveys. The road will connect with the Wallingford terminus of the Meriden Electric Company's system, and will run to Montowese, where it will join the Fairhaven & Westville Railroad Company's lines. The road will be the connecting link of a continuous electric railway between Boston and New York, about 8 miles of line are to be built, and six double truck cars are to be operated. A power station is to be built, and a feature of its equipment will be two steam turbines. Two 500-kw generators and three 300-hp water tube boilers will also make up part of the station equipment.

BELLEVILLE, ILL.—The Illinois Transit Company has filed a certificate of incorporation. The capital is $1,000,000. The incorporators are Charles E. Thomas, B. H. Portuondo, Charles W. Thomas, Lilburn G. McNair and Fletcher R. Harris.

BELLEVILLE, ILL.—The Belleville & Smithton Electric Railway Company has filed certificate of incorporation. The capital is $300,000 and the incorporators are G. G. Bock, Charles E. Thomas, Fred L. Geissler, G. A. Koerner, Jr., and Lilburn G. McNair.

SHELBYVILLE, ILL.—Articles of incorporation of the Rock Island, Keithsburg & Southern Railway Company have been filed. The incorporators and members of the first board of directors are Hal. B. Allen, Van S. Allen and Charles F. Lathe, of Erie; Howard N. Ogden and John O. Allen, of Chicago. The capital stock is $25,000.

INDIANAPOLIS, IND.—Interests identified with the Indianapolis & Martinsville Traction Company plan to build an electric railway from Martinsville to Bloomington, a distance of 23 miles.

INDIANAPOLIS, IND.—George F. McCulloch, president of the Union Traction Company, has verified the report of the purchase by Union Traction interests of the two interurban lines connecting Peru and Wabash, and Peru and Logansport. Mr. McCulloch refused to state the consideration, but it is understood to be $800,000.

INDIANAPOLIS, IND.—The Indianapolis, Shelbyville & Southeastern Interurban Company has passed to the ownership and control of R. C. Light and Fletcher Hines, Indianapolis capitalists. The road cost the two men nearly $600,000. The company has reorganized and the following directors chosen: R. C. Light, Fletcher Hines, M. B. Wilson, Howard Cole and M. B. Dawson. Mr. Light is president and Mr. Dawson, secretary. The new officials say the new company will carry out the plans of the old and extend the line to Cincinnati, by way of Greensburg.

IOLA, KAN.—The Southern Kansas Electric Railway Company has been chartered under the laws of New Jersey to build an electric railway between Iola and Pittsburg. The capital stock is $325,000, and the officers are F. M. Hyde, president; Charles B. Ebert, vice-president; L. L. Northrup, treasurer; E. S. Slough, attorney; L. P. Stover, engineer.

OWENSBORO, KY.—It is stated that the proposed electric railway between Owensboro and Hartford has been financed. The road will be fifty-three miles long, and will run from Owensboro to Hartford. The power house will be located at Curdsville, 13 miles from Owensboro. Both passenger and freight trains will be operated. E. Rice, of Louisville, and Wade Cushing, of Cincinnati, are interested.

PASCAGOULA, MISS.—The Pascagoula Railroad & Power Company has been organized at Louisville, Ky., with a capital stock of $400,000. The company will build an interurban electric railway in Mississippi and control the utilities of Pascagoula, Scranton, East Side and Moss Point. Electric light and power plants, water works and ice factories are included. The officers are Charles T. Ballard, president; L. S. Anderson, of Moss Point, Miss., vice-president; V. Spratt Bridges, secretary; the Columbia Finance & Trust Company, of Louisville, treasurer; S. S. Boyd, general manager.

KANSAS CITY, MO.—It is said that the Topeka, Lawrence and Kansas City Electric Railway Company, of which T. S. Salathiel is president, has been financed and that the contract for building the road has been let. The company was organized Nov. 8, 1901.

JEFFERSON CITY, MO.—Articles of incorporation have been issued to the St. Louis & St. Paul Railroad Company of Kansas City. The company is capitalized at $1,000,000, and proposes to build a railway 100 miles in length. Among the incorporators are Samuel F. Scott, Thomas S. Ridge, W. C. Picking, R. D. Kathrens and A. C. Kinneard. The St. Joseph, Parkville and Kansas City Railway was also chartered. Capital $5,000,000. The incorporators are L. W. Prior, Geo. W. York, Joseph R. Nutt, of Cleveland, Ohio; M. A. Devitt and A. W. Howard, of Chicago; John J. Tootle, C. F. Enright, R. M. Davis and A. B. Weakley, of St. Joseph; J. L. Brown, of Kansas City; E. B. Snider, of Leavenworth, and H. B. McAfee, of Parkville, Mo.

WASHINGTON, N. J.—The Eastern & Washington Traction Company has filed articles in the office of the Secretary of State at Trenton, increasing the capital stock of the company from $100,000 to $1,250,000. The company will build an electric railway from Easton to Hackettstown and from Belvidere to Clinton, a system 40 miles long, with Washington as the center. The officers of the company are Robert M. Petty, of Washington, president; W. O. Hay, of Easton, Pa., secretary; R. M. Eilenberger, of Washington, treasurer.

ROME, N. Y.—The Utica & Mohawk Valley Railroad, which has purchased the Rome City Street Railway, will begin at once to equip it with electricity, making it a part of the system which the Utica & Mohawk Company operates throughout Central New York. The Rome road has been operated by compressed air.

NEW YORK, N. Y.—The plans of the New York Central Railroad for the change of motive power in the Park Avenue tunnel from steam to electricity, the addition of ten stories to the present Grand Central Station, the construction of an annex and the other improvements to the Forty-second Street terminal have been completed. These plans will be submitted to the Board of Estimate, and when the city's approval is secured work will be undertaken at once.

NEW YORK, N. Y.—The last obstacle in the way of beginning work on the Pennsylvania's great underground terminal project in this city has been removed. The Appellate Division of the Supreme Court has announced a decision confirming the finding of the commissioners appointed to report whether the tunnel across Manhattan Island under and between Thirty-second Street and Thirty-third Street ought to be constructed and operated. The commissioners had reported that the tunnel railroad as planned ought to be constructed and operated, and the decision winds up the court proceedings. The Board of Aldermen has approved the enterprise, and it is understood the work may now begin.

NEW LEXINGTON, OHIO.—The Perry County Electric Railway & Light Company has been incorporated with a capital of $10,000 by M. H. Donahue, A. Bringardner, C. A. Donahue, William E. Fink and W. S. Bartlet.

COLUMBUS, OHIO.—The Youngstown & Salem Railroad Company and the Youngstown & Southern Railway Company have been incorporated by Ashabel W. Jones, R. L. Andrews, John H. Ruhlman, Jonah R. Long, W. S. Anderson and Jasper W. Long. The former has $300,000 and the latter $1,500,000 capital stock. The latter is to run from Youngstown to East Liverpool and the former makes a connection near Leetonia and runs to Salem. Both are to be electric lines.

PITTSTON, PA.—The Wilkesbarre-Wyoming Valley Traction Company is contemplating the erection of a large power house in this city.

PHILADELPHIA, PA.—It is stated that the American Railways Company has purchased the entire capital stock and all the bonds of the Tyrone Electric Railway and the Tyrone Electric Light & Heat Company, of Tyrone, Pa.

PHILADELPHIA, PA.—President James D. Callery of the Pittsburg Railways Company and other capitalists associated with the Widener-Elkins syndicate are interested in a new company which will shortly be incorporated with $100,000 capital to build a through trolley road between Pittsburg and St. Louis.

GREENVILLE, PA.—The Borough Council has granted a street railway franchise to Congressman Ernest Acheson and Hon. J. V. Clark, of Washington, Pa., and W. I. Berryman and J. W. Taylor, of Pittsburg, who recently purchased the plant of the Greenville Water Company. The road is to be called the Greenville & Westside Street Railway.

HARRISBURG, PA.—At the meeting of the directors of the Harrisburg Traction Company to consider the reorganization plan adopted at the recent special stockholders' meeting, it was decided to call the new corporation the Central Pennsylvania Traction Company. An application for a charter will be made. The capital stock of the new corporation will be $2,100,000, and it will take over the lines of the Harrisburg Traction Company July 1, 1903. The officials and directors of the present company will continue in the same capacity with the new company.

PITTSBURG, PA.—The Pittsburg Railways Company has its new sub-power station at Coraopolis in operation. The station contains one 400-kw. rotary converter and a storage battery equipment of about the same capacity. It will be used to supply power for the Coraopolis division. The new power house of the Pittsburg, McKeesport & Connellsville Railway Company, near the latter named place, is now in operation. The equipment includes six 1,500-kw Westinghouse generators operated by three Westinghouse steam turbines and three Allis-Chalmers engines. This plant will supply the power for the entire system. It cost approximately $1,000,000.

TIVERTON, R. I.—The Legislature has passed an act incorporating the Tiverton & Sakonnet Beach Railway Company, in Tiverton and Little Compton, R. I. The capital stock is fixed at $200,000. Among those interested in the company are William H. Briggs, Abel B. Simmons, Clarence C. Wordwell, Charles R. Wilbur and F. F. Grinnell.

SALT LAKE CITY, UTAH.—Plans are being laid for the construction of an electric railway system between this city and Ogden, a distance of 35 miles. The project is being pushed by Mr. Simon Bamberger, a wealthy business man of Salt Lake.

CHARLESTON, W. VA.—The Luke, Westport & Keyser Electric Railway Company, of Keyser, has been incorporated, with a capital of $5,000. Incorporators: Max Wineland, Robert Amau, Frostburg, Md.; Hugh Scott, Macuny, Md., and John Mackle, Westernport, Md.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Traction Company, of Fairmont, is to construct an electric railway from Burnsville to Clarksburg. The capital is $2,000,000, and the incorporators are S. L. Watson, L. L. Malone, C. Powell, Walton Miller, M. L. Hutchinson, of Fairmont.

NEW INDUSTRIAL COMPANIES.

THE NEW YORK AUTO-CAR COMPANY, of New York, has been incorporated, capital $30,000. Directors: Bernard Uhren, John Lurie and J. J. Head, New York.

THE LEE ELECTRIC INSOLE COMPANY, of Jersey City, has been incorporated with a capital of $100,000. Incorporators: Frederick S. Van Vleck, Charles M. Coburn and Frank B. Lee.

THE ELECTRIC CHAIR COMPANY has been incorporated at St. Louis with a capital stock of $75,000 all paid up. The stockholders are Semple S. Scott, Gustavus A. Brecht, Edward A. Faust, Henry Koehler, Jr., Joseph S. Dobyns and Charles Erd.

THE CINCINNATI CONSTRUCTION COMPANY, Cincinnati, Ohio, has been incorporated with $10,000 capital, by W. P. Deppe, Willard Stone, C. H. Deppe and C. C. Clark. It will construct steam and electric railways and engage in mechanical engineering.

MESSRS. BARTZ, WYANT & BROWN have incorporated at Hornellsville, N. Y., to manufacture and deal in electric motors and appliances. The capital is $60,000. The directors are Frank Bartz, Frederick A. Wygant and Alfred E. Brown, of Hornellsville.

THE VIDEX AUTOMOBILE COMPANY has been incorporated in New Jersey, to make and sell steam, electric and gasoline automobiles. The allowed capital is $1,000,000. Incorporators: Charles A. Greene, James B. Richardson and Gerald A. Griffen.

THE IDEAL ELECTRIC MANUFACTURING COMPANY, Mansfield, Ohio, capital stock, $50,000, has been organized to make electrical supplies and novelties. C. H. Voegele, John Krause, J. F. Stone, M. L. Branyon, S. E. Huenerfauth and others are interested. The company will erect a factory.

THE MATHIS BROS. COMPANY has been incorporated at Indianapolis, Ind., to manufacture ventilating apparatus and all kinds of electrical and mechanical devices. The capital stock is $130,000. The company's plant will be located at Hammond. The directors are Julien W. August, George Mathias and Andrew Swickel.

THE MUSIC DUPLEX TYPEWRITING WIRELESS TELEGRAPH COMPANY, of Portland, Me., has been incorporated to make and deal in telegraph and telephone instruments. The capital stock is $1,000,000, of which nothing is paid in. The officers are: President, J. T. Fagan; treasurer, G. F. Gould, both of Portland, Me.

THE HEAWATH ELECTRIC COMPANY, of Detroit, Mich., has been incorporated with a capital stock of $60,000. The company will make incandescent lamps and handle other electrical specialties. It is now negotiating for a site for its plant. The names of the incorporators are Hoyt Post, S. C. Mumford, Lucien S. Moore, W. S. Reynolds and others.

GOULD STORAGE INTERESTS.—The Gould Coupler Company and Gould Storage Battery Company have been incorporated with the New York Secretary of State, each capitalized at $5,000,000. The companies are to take over the business of the Gould Storage Battery Company and the Gould Coupler Company, West Virginia corporations. The directors are Charles A. Gould, Charles M. Gould, William S. Gould and Frederick P. Hawley, of New York City.

LEGAL.

STORAGE BATTERIES.—In the suit of the Hopedale Electric Company against the Electric Storage Battery Company of Philadelphia, for $750,000 and patent rights, the New York Supreme Court has decided that the Storage Battery Company not only owns the Hopedale system and the patents covering it, but rejects the Hopedale Company's claim of $750,000.

THOWLESS VS. NERNST INTERFERENCE.—The United States Patent Office, through Commissioner of Patents Allen, has confirmed the decision of the examiners-in-chief, awarding priority of invention to Nernst over Thowless. In this decision considerable doubt and discredit is thrown upon the evidence put forward by Thowless to show that he anticipated Nernst in the principle of the practical glower lamp. In addition "Even if it is conceded that Thowless did this in 1896, it must be regarded as an abandoned experiment. The evidence indicates that it was not regarded as a successful demonstration of the practicability of the invention. The lamps are said to have burned from 10 to 20 minutes; but when in 1900 Thowless attempted to repeat these experiments to show how they occurred, most of his tests were total failures. . . . Even if the early abandoned experiments by Thowless be regarded as showing a conception of the invention, the decision must be against him, because of his lack of diligence." The action was on the Nernst Patent No. 623,811 of April 25, 1899, and was conducted by Mr. H. C. Messimer for Thowless and by Mr. Charles A. Terry for Nernst.

NEW YORK INDEPENDENT TELEPHONE.—The Independent Telephone Company has obtained from New York Supreme Court Justice Clark a writ, returnable before him in a few days directing Commissioner Monroe of the Department of Water Supply, Gas and Electricity, to show cause why a peremptory mandamus should not issue compelling him to grant to the company the permit to open the streets. The company was organized and incorporated in 1899, with a capital of $100,000, with the privilege of increasing it to $20,000,000. It proposes to install 100,000 telephones in Manhattan, to run a line over Long Island to Montauk Point, and north in the State to Rouses' Point, besides in the various boroughs comprising Greater New York. It proposes also to pay the city $1 for each telephone installed. The necessary franchise the officers of the company say they have, having obtained it under Articles 5 of the New York State transportation laws. When, however, they applied to Commissioner Monroe for the necessary permit he refused it, on the ground that the new city charter had repealed the law and vested the granting of franchises in the Board of Aldermen. This is denied by the company, which maintains that its franchise gives it the power to put in its poles and wires, subject only to a permit from Commissioner Monroe which requires the ordinary precautions in such work. The officers of the company state that they had the utmost confidence in Commissioner Monroe and knew his attitude to be sincere, but that they feared in other ways efforts were being exerted to balk them in securing their permit, and that they had for that reason applied to the Supreme Court. Among some of the promises of the company are these: Single calls, 5 cents; an unlimited service in the Borough of Manhattan for $125 a year; 600 calls for $45; 800 calls for $55; 1,000 calls for $60. In the Borough of Brooklyn it intends, according to its promise, to give unlimited service for $75.

EDUCATIONAL.

WORCESTER POLYTECHNIC INSTITUTE.—The annual commencement lecture before the Washburn Engineering Society of the Worcester Polytechnic Institute, was delivered this year by Professor Harold B. Smith, of the electrical engineering department of the Institute on the evening of June 9. The lecture was given in the electrical engineering lecture room of the Salisbury laboratories at 8 o'clock, and was illustrated by about one hundred lantern slides and an experimental demonstration of high potential power transmission. The subject "The Relation of the Electrical Engineer to Modern Social and Industrial Progress" was treated from a standpoint of general interest rather than from a purely technical point of view, and the lecture was of considerable interest to the commencement guests and Worcester friends of the Institute.

MICHIGAN COLLEGE OF MINES.—The Legislature of Michigan has passed a bill appropriating $171,900 for the Michigan College of Mines at Houghton for the biennium beginning July next. The most important item of this appropriation is that of $45,000 for the construction of a metallurgical laboratory. The college intends to erect a substantial building for this purpose and to equip it thoroughly for experimental work and instruction in the different classes of metallurgical processes. Cyaniding and other wet methods of concentration will be exemplified in the equipment, and electrometallurgy will receive special attention. It is intended to instal furnaces of larger capacity than is usual in college laboratories. The board of control of the college is taking steps to create a separate department of ore dressing and metallurgy. The equipment for this department will be housed in the new metallurgical building and in the ore dressing mill now possessed by the college. A man to fill the new chair has not been selected. Beside the amount for a metallurgical laboratory, the bill referred to carries an appropriation of $9,000 for extending the equipment of the department of mining engineering, which now occupies its new building erected last year; $4,000 for completing the equipment of the chemistry building also erected last year; $2,000 for providing additional cases for the mineralogical museum, and $1,000 for increasing the equipment of the department of mechanical engineers.

PERSONAL.

CHARLES BRANDEIS.

MR. CHARLES BRANDEIS.—A young electrical engineer who has been doing excellent work in Canada is Mr. Charles Brandeis, who has now established himself as a consulting, electrical and mechanical engineer with offices at 112 St. James Street, Montreal. Mr. Brandeis was born in London, England, graduated from the City and Guilds of London Central Institute at the age of twenty and was awarded the diploma and associateship of that institution. He obtained subsequently a large experience with leading electrical companies on the continent of Europe in the design and operation of electric light, power and railroad plants. In 1898 he came to the United States and worked for a couple of years with the General Electric and Westinghouse companies. In 1900 he went to Canada as designing engineer of the Lachine Rapids Hydraulic and Land Company, where he has done some excellent work. When the Lachine Company was absorbed recently by the Montreal Light, Heat & Power Company, he resigned his position to take up consultation work. Mr. Brandeis now has on hand electric light plants for three provincial towns and is also interested with a number of capitalists in the development of a large water power for manufacturing purposes. Mr. Brandeis is well-known personally in the electrical field in the United States and also through the columns of this journal, to which he has been a frequent contributor.

MR. H. S. COLLETTE, of the electrical engineering and contracting firm of J. G. White & Co., 29 Broadway, New York, has sailed for a trip to Europe.

MR. FRANCIS BLOSSOM, of the electrical engineering and contracting firm of Sanderson & Porter, New York City, has returned from an extended trip to the Southern States.

MR. CHARLES A. MOORE, of Manning, Maxwell & Moore, and president of the Shaw Electric Crane Company, of Muskegon, Mich., has returned from a seven months' trip abroad.

MR. G. F. BREITENSTEIN, superintendent of fire alarm telegraphs, of Utica, N. Y., died on June 2 of typhoid fever. He was a member of the International Association of Municipal Electricians.

MR. H. WARD LEONARD has been asked by the British Navy to tender bids for equipping H. M. S. *Terrible* with electric turret turning devices, with which such excellent results have been obtained on American men-of-war.

MR. HEINRICH JAEGER, one of the managers of Escher Wyss & Co., of Zürich, the turbine-builders, is in the United States for a short stay and may be addressed, care Mr. Clemens Herschel, the hydraulic engineer, 2 Wall St., N. Y. City.

MR. JACOB CLOOS, of Milwaukee, has been appointed consulting engineer by the city council of Sheboygan, Wis., for the proposed municipal electric light plant for street and commercial lighting in conjunction with the new water works system.

MR. ROBERT C. CLOWRY, president of the Western Union Telegraph Company, has accepted an invitation to become a Director of the Kansas City, Mexico and Orient Railway Company, with which road the Western Union has a twenty-five-year contract.

MR. E. H. ABADIE.—Mrs. Ida Foree Bolling, of Louisville, Ky., announces the engagement of her daughter, Miss Alice G. Bolling, to Mr. Eugene H. Abadie, of St. Louis, and general manager in New York of the Elblight Company of America. It is said they will be married in the fall.

MR. ISAAC L. RICE, president of the Consolidated Railway Electric Lighting & Equipment Company, has sailed for Europe. According to present arrangements he will be on the other side for about four months in the interest of the various concerns with which he is connected on this side.

MR. LOUIS F. MASSA, C. E., secretary of the A. D. Granger Company, contracting engineers, of 95 Liberty Street, New York, sailed on the S. S. *Minneapolis,* Saturday, June 6, for an extended tour abroad. Mr. C. C. Tomkinson, M. E., has been appointed assistant secretary of the Granger Company, and Mr. L. A. Camacho, manager of the sales department.

MR. E. P. MATHERS, F. G. S., F. R. G. S., who is interested in the electrical utilization of the falls of the Zambesi, South Africa, is reported in this country to study the conditions at Niagara, etc. The average estimated horse-power of the Victoria falls is 35,000,000-hp and the transmission distances figured on are from three to five hundred miles.

PROF. J. J. THOMSON, of the Cavendish Laboratories, Cambridge University, England, is to receive an honorary degree this week at Columbia University, New York, in recognition of his work in molecular and electrical physics. He is now in this country and was offered the physics chair of Prof. Rood at Columbia, upon the latter's death, but declined.

MR. CHARLES ALDEN, of Dorchester, Mass., has just completed a series of experiments by which he is enabled to control all the movements of a boat in mid-stream while sitting on the banks. The scene of his operations is at Milton, on the Neponset River. He is now at work on a model of a lifeboat to be similarly managed, which he believes he can imitate in bigger boats. There is nothing new whatever about the general idea, at which Tesla and others have worked.

MR. GEORGE HERBERT CONDICT, of New York, a well-known electrical engineer, has been elected vice-president and general manager of the old established Electro-Dynamic Company, of Philadelphia, to whose affairs he will now give part of his time. The company has won a well deserved reputation for its specialties, and will, it is understood, add shortly to its lines of production. Mr. Condict's predecessor in office, Mr. Paul, will, it is understood, remain on the directorate.

MR. W. J. McMANIGAL resigned recently his position as general manager of the New Omaha Thomson-Houston Electric Light Company, of Omaha, Neb., and the duties of general manager have been assigned to the president of the company, Fred A. Nash. R. A. McLaughlin has been made general superintendent and W. B. Whitehorn, purchasing agent. The New Omaha Thomson-Houston Electric Light Company now controls the light and power situation in Omaha and South Omaha, Neb., and in Council Bluffs, Iowa.

MR. J. C. HOBART.—The deserved compliment of a complimentary dinner was recently tendered to J. C. Hobart, of the Triumph Electric & Ice Machine Company, at the Business Men's Club of Cincinnati by participants of the Business Men's Excursion to New Orleans and other Southern points during the recent convention of the National Association of Manufacturers. Mr. Hobart was also presented with a silver loving cup as a token of appreciation of his services rendered as the chairman of the general excursion committee.

DAVIS-BARRETT.—We are happy to record the marriage at Saratoga, N. Y., on June 3, of Grace Inez, daughter of Mr. and Mrs. J. M. F. Barrett to Mr. Harold McGill Davis, well-known in the electrical field and for some years past advertising manager for the Sprague Electric Company. The wedding took place at the home of the bride's parents, the ceremony being performed by Rev. Milton T. Littlefield, cousin of the groom. Only the relatives and a few intimate friends were invited. The bride wore gray crepe de chine. Mr. and Mrs. Davis will spend part of the month traveling through the New York Lake District and along the New England coast, and will then make their residence on the upper west side of New York City.

LORD KELVIN is one of the subjects selected for portraiture in the *Booklover's Magazine* for June. Prof. A. W. Goodspeed says: "It seems to be the delight of some biographers to lay great stress upon the desirability, if not necessity, that a man to be really great in any walk of life should start with nothing but a shoe-blacking outfit, or perhaps with the borrowed price of a first batch of newspapers. For the encouragement of those whose parents possess more than average intelligence and education and who may even be supplied with some of the comforts of life, let it be borne in mind that Lord Kelvin, the man of genius and learning, was born of highly educated parents and has ever lived surrounded by an atmosphere of culture and refinement."

MR. EDWARD F. SCHURIG, for the past six years city electrician of Omaha, Neb., has resigned his position to accept one as manager of the Beatrice Electric Company, of Beatrice, Neb. Mr. Schurig succeeds Mr. E. J. Sullivan, who has recently entered business in Omaha as general manager of the Nebraska Electric & Fixture Company. Mr. Schurig is one of the best-known electrical men in Nebraska and his record as city electrician has been an excellent one. His work in Beatrice will include the general improvement and extension of the company's plant and system. Paul H. Patton succeeds Mr. Schurig as city electrician of Omaha. Mr. Patton is an experienced telephone man having been with the Nebraska Telephone Company in Omaha for nearly ten years, and before that with the Western Electric Company, in Chicago, and the Colorado Telephone Company, in Denver. At the time of his appointment, he was in the engineering department of the Nebraska company and acting as superintendent of equipment.

Trade Notes.

THE WOODHILL & HULSE ELECTRICAL COMPANY, Los Angeles, Cal., has purchased the Western & Southern Electrical Works. This will give the former concern control of most of the electrical business of Los Angeles.

AUTOMOBILE AND CYCLE MATERIAL.—Mr. Chas. E. Miller, 97 Reade Street, New York, has issued a very complete catalogue showing a new line of automobile parts, fittings, and sundries and many European novelties. The catalogue covers the ground very thoroughly and a copy will be mailed to any one interested on application.

THE PLUNGER ELEVATOR COMPANY, of Worcester, Mass., has sold, through its New York office, 156 Fifth Ave., an elevator with a lifting capacity of 14,000 lbs. to the MacAndrews & Forbes Licorice Co., Camden, N. J. The elevator will carry loaded cars from one floor to another, the total travel being 24 feet. No counter weights or cables will be used in this installation.

REYNOLDS CORLISS ENGINES.—A trade publication somewhat unique in character has been issued by the Allis-Chalmers Company, which consists entirely of the names and addresses of users of Reynolds Corliss engines, classified according to lines of manufacture. No less than 189 pages are necessary to contain the list, electric railway and lighting plants alone taking up 31 pages.

THE BENJAMIN ELECTRIC MFG. COMPANY, of Chicago, has opened an Eastern office at 27 Thomas St., New York, where it will keep on hand a large stock of its regular manufactures among which is the Benjamin wireless cluster that has attained an enviable reputation in electrical circles. The stock in the East will enable the company to fill orders promptly either from New York or Chicago.

PUMPING MACHINERY.—The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, in a recently issued catalogue (No. 53), describes and illustrates its full line of pumping machinery ranging from small single pumps, to triple-expansion pumping engines, and including vacuum hydraulic pumps, triplex power pumps, air compressors, etc. The extent of the line may be surmised by the fact that the catalogue contains 114 pages and almost 100 illustrations.

OPENING-DIE.—The Ideal Opening Die Company, 24 West Street, New York City, in a recently issued pamphlet describes briefly and illustrates its "Ideal" opening-die, which is designed for use in connection with either hand of automatic turret machines. The advantages derived from the use of the device are briefly pointed out, and the two-page illustration at the center of the booklet shows its construction very clearly. This opening-die is at present made in four sizes, that is, ¼ in., ½ in., ¾ in., and 1 in., and larger sizes will be manufactured.

THE F. BISSELL COMPANY, Toledo, Ohio, has just issued two booklets upon the subjects of switchboards and specialties for electric lighting, power and railway construction, and specialties for telephone construction. The former illustrates and gives prices of pole ladders, seats and platforms; alley braces for side arms; cable and messenger cars; manhole tops; conduit rods; and a line of tablet boards. Views of three switchboards constructed by this company are also given. The telephone pamphlet covers a full line of articles used in telephone work and construction.

TELEPHONE EQUIPMENT.—The Conn. Telephone and Electric Company, Meriden, Conn., is sending out a new catalogue which shows a large number of improvements, and new styles of telephone apparatus. Among the latter are noticed the company's solid back transmitter, which has a new resonating chamber; a new self-contained receiver and switch hook; a new style of switchboard, etc. The company has moved into a larger factory which gives a greater producing capacity, and it reports that it has a large number of big contracts on hand and that the business prospects are exceedingly bright.

TELEPHONE APPARATUS.—The De Veau Telephone Manufacturing Company, 27 Rose St., New York, introduces to the trade from time to time new telephone apparatus, and has built up a large business and an excellent reputation for the quality and efficiency of its goods. The extent of its line of products may be appreciated by an examination of its latest catalogue, which has 128 pages, and includes descriptions and illustrations of its telephone apparatus and supplies. The interior telephones made by this company are well shown. Every one concerned in telephone work will find much matter of interest in this catalogue.

BULLOCK BULLETINS.—The latest bulletins of the Bullock Electric Mfg. Company have for their subjects, Bullock engine type generators for direct current (No. 1008), and Bullock Type B motors (No. 1021). Both bulletins are printed on an excellent quality of paper and we have seen very few machinery half tones equal to those printed in these pages. In the first mentioned bulletin, every constructional detail down to the smallest is well illustrated, and a large number of plants are shown where the generators are installed. The second bulletin includes an interesting efficiency curve of 2½-hp and 5-hp moderate speed motors.

DIRECT-CONNECTED EXHAUST FANS.—The Emerson Electric Mfg. Co., St. Louis, Mo., has just issued a bulletin (No. 3040) on direct connected

exhaust fans for alternating and direct current. It presents an extended list of fans of this class, of design similar to those now so well-known in the trade. They were brought out to meet the demand for very quiet running fans, and are fitted with Davidson blades in order to insure quiet operation. The company continues to supply Parker blades for exhaust fans where a slight noise is not objectionable. The two styles throw an equal volume of air, the choice being largely determined by the matter of slight noise or no noise.

DIRECT-CURRENT GENERATORS.—Bulletin No. 30 of the Northern Electrical Manufacturing Company, Madison, Wis., is a profusely-illustrated pamphlet of 32 pages, devoted to a description in detail of direct-current generators. There are no less than 50 half-tone illustrations, which are so excellent in execution that we cannot forbear mentioning the name of the engraver —Franklin Engraving Company, Chicago. The minutest details of construction are illustrated and machines are shown direct-connected to almost every modern type of steam engine. An interesting section of the catalogue is devoted to describing and illustrating a twin type of generator that has been designed for use with the steam turbine.

VENICE IN AMERICA.—One of the splendid pieces of illumination in New York City is "Venice in America" at the Madison Square Garden. The incandescent lights in the ceiling are in general blue. The Duss orchestra is placed in a court of honor staging, surrounded by high pillars resembling marble, wreathed with vines and ropes of incandescent lamps of greenish tinge. At the foot of the Rialto Bridge are two immense pillars, one entwined with red incandescents and the other with blue, while over the entire canal hang Venetian lanterns lit by incandescent lamps—an odd mixture of ancient and modern illuminating effects. The lamps used in this production were furnished by the Germania Electric Co., Harrison, N. J.

SCIENCE IN THE MAGAZINES.—Conclusions so startling as those reached by Dr. Wallace's *Fortnightly* article on "Man's Place in the Universe," could not go long unchallenged, and the April number of the *Fortnightly* brings a prompt reply from no less an authority than the Savilian Professor of Astronomy at Oxford. Professor Turner's article is reprinted in *The Living Age* for May 9, which is full of timely articles. Professor Harnack comments on "The Kaiser's Letter on Christ and Revelation;" there is a review of Mr. Chamberlain's career from *Blackwood's Magazine;* and a discussion of "The Unrest in the Balkans," by the Roumanian ex-Minister of Public Instruction, the vice-president of the Central Macedonian Committee and the President of the Cretan Chamber of Deputies.

BUFFERS AND GRINDERS.—The Storey Motor and Electric Company, 135 Broadway, New York, devotes a recent catalogue entirely to the subject of buffers and grinders. The various types of these machines are illustrated by excellent half-tones and the dimensions are given in tables for use in connection with diagrams of the machines. The pamphlet is of extraordinary value by reason of the practical information it gives at the back on the subject of silver polishing, gold polishing, copper and brass finishing. These buffers and grinders are designed expressly for this service and may be set up on a bench or table at any convenient point. They may be run from an ordinary lighting or power circuit at either 110 or 220 volts. A substantial column is furnished with the machine if desired.

BOOKLOVERS' MAGAZINE.—The new *Booklovers' Magazine* is already famous for its pictures. In the May number, among other illustrations, there are fifteen full-page pictures of scenery and figures reproduced in natural colors by the three-color process, six full-page portraits in tints, and ten full page half-tones in black and white. These pictures illustrate articles by Talcott Williams, W. R. Hotchkin and Cyrus Townsend Brady on Department Stores, having full-page portraits of the great leaders; the vacation-travel articles by Lilian Bell, Julian Hawthorne, Jeannette L. Gilder and Mary Bacon, with many European views; and the critiques by Oscar Fay Adams, Agnes Repplier, Mary E. Wilkins, and Katharine Lee Bates on the immortal women novelists—Jane Austen, George Eliot, George Sand, and the Brontës.

EWING-MERKLE ELECTRIC COMPANY.—The Ewing-Merkle Electric Company, St. Louis, Mo., formally opened its new store at 1106 Pine Street, that city, May 25, a large and representative gathering being in attendance to inspect the new quarters. On the first floor there are specially designed show cases containing samples of nearly all the small material needed in the lighting and telephone industries. Beyond the city counter is the exhibit room, in which are contained motors, dynamos, arc lamps, switchboards, electric fans, telephone and electric fixtures, and the larger articles used by contractors in electric lighting and telephone companies. The shipping and receiving departments are also favorably located on these floors. The basement contains large stocks of Roebling's telephone wire, cross-arms, glass insulators, and iron conduit. The general offices of the company are located on the second floor and are handsomely fitted up and so arranged as to afford the greatest convenience in the transaction of business. On the third floor the lighting supplies are kept, and the fourth floor contains all the copper wire—rubber-covered, water-proof, magnet—annunciators and cables, of all of which the stock is very complete and excellently arranged. On this floor also shelving is provided for glass shades, reflectors and incandescent lamps. On the fifth floor are kept in standard packages goods that are not unpacked on the premises, such as electric fans, arc lamps, sockets, cut-outs, etc., etc.—in fact, everything ordered out in original packages. Brackets, pins, construction tools, etc., are kept in large stocks on the sixth floor. During the reception refreshments were served, and all present extended cordial wishes for the prosperity of the company.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JUNE 2, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

728,309. COIN-COLLECTOR FOR TELEPHONE PAY-STATIONS; Charles E. Scribner, Chicago, Ill. App. filed July 29, 1901. (See page 1015.)

728,478. TELEPHONE-LOCK; Edward G. Lewis, St. Louis, Mo. App. filed June 20, 1902. (See page 1015.)

728,833. SIGNAL DEVICE FOR TELEPHONE SYSTEMS; Edward P. Baird, Evanston, Ill. App. filed April 14, 1902. (See page 1015.)

728,964. TELEPHONE-TOLL SLOT-MACHINE; William S. Paca, Erie, Pa. App. filed Aug. 26, 1902. (See page 1015.)

728,994. TELEPHONE-LOCK; William H. Scott, St. Louis, Mo. App. filed June 25, 1902. (See page 1015.)

729,184. TRANSMITTER-ARM; William Kaisling, Chicago, Ill. App. filed Dec. 8, 1902. (See page 1016.)

729,267. TELEPHONE-RECEIVER HOLDER; Arthur J. Briggs, Allegheny, Pa. App. filed Sept. 6, 1902. (See page 1016.)

729,523. SAFETY GUARD FOR TROLLEY WIRES AT RAILROAD CROSSINGS; Charles D. Austin, Amsterdam, N. Y. App. filed April 10, 1903. Energized guards are arranged adjacent to the trolley wire, so that in case the trolley leaves the wire while crossing the track, it will strike a guard and receive current therefrom to carry the car over the crossing.

729,550. BATTERY JAR; George H. Condict, New York, N. Y. App. filed Dec. 16, 1898. The exterior walls of the cells have ribs which come together when the cells are nested, and thus support the walls and furnish intervening spaces for carrying away spilled solution.

729,560. SIGNALING-JACK FOR MULTIPLE-TELEPHONE EXCHANGES; Lars Magnus Ericsson, Stockholm, Sweden. App. filed Feb. 12, 1901. (See page 1016.)

729,614. PROCESS OF TREATING MATERIALS BY RADIATED HEAT IN ELECTRIC FURNACES; Carl G. P. De Laval, Stockholm, Sweden. App. filed March 19, 1902. The material is piled up in the furnace chamber and presents an inclined side to the heat of an arc. As the material is decomposed, it runs downward into a receptacle.

729,620. TROLLEY STAND; William Magner, Lockport, N. Y. App. filed Nov. 6, 1902. Details.

729,640. BRAKE FOR ELEVATORS; John P. McCurdy, Chicago, Ill. App. filed June 9, 1902. The momentum of the armature of the hoisting motor, after the current is shut off, is used to generate current to operate a brake magnet.

729,655. WINDING OR REVOLVING MAGNETS; Charles A. Parsons, Newcastle-upon-Tyne, England. App. filed Oct. 7, 1902. Non-magnetic bridge pieces are inserted between the pole pieces of a rotary field magnet and serve as supports for the conductors to prevent their displacement by centrifugal force.

729,657. TROLLEY CATCHER; William E. Pettee, Newton, Mass. App. filed Feb. 21, 1901. Details of a spring drum retriever.

729,658. BRAKE FOR CARS; Bertil Von Philip, Philadelphia, Pa. App. filed Jan. 22, 1903. Alternate friction disks are clamped and separated by an electro-magnet and a spring.

729,662. ELECTRIC IGNITION GENERATOR; Benjamin P. Remy, Anderson, Ind. App. filed April 17, 1902. The machine is mounted to slide on rails, but is held by a spring to maintain a proper tension on the belt.

729,664. ELECTRIC MOTOR; Edgar G. Richards, Madison, Wis. App. filed June 30, 1897. A counter shaft with which the armature is geared, is mounted in brackets extending from the heads of the motor which are adjustable at any angular position around the motor axis.

729,703. MEANS FOR INDICATING THE IMPACT OF BODIES AT A DISTANCE; Juna U. Y. Motta, Getafe, Madrid, Spain. App. filed Oct. 28, 1901. A pivoted plate mounted on a target vibrates a number of times depending upon the distance from the pivot at which it is struck by the bullet; the vibrations operate an indicator.

729,716. MEANS FOR ELECTRICALLY OPERATING COUNTER SHAFTS; Norman C. Bassett, Lynn, Mass. App. filed Feb. 27, 1902. An arrangement for throwing a friction pinion into contact with either one of two concentric surfaces on a pulley, to change the speed and direction of rotation.

729,729. FUSIBLE ELECTRIC CUT OUT; William P. Burke, Fethard, Ireland. App. filed Feb. 24, 1903. The fuse wire is stretched over a bridge like a violin string, the bridge preventing the formation of an arc.

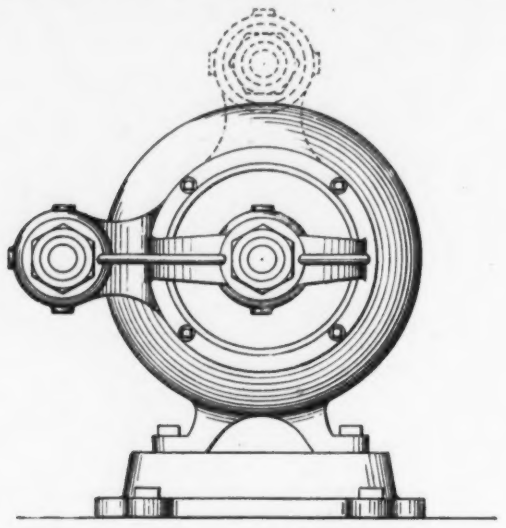
729,730. INCANDESCENT LAMP; William R. Burrows, Newark, N. J. App. filed Jan. 30, 1901. Means for preserving the seal of an incandescent lamp, comprising heat radiators of large area compared to the leading-in wires and surrounding each wire below the filament-joint.

729,734. BRAKING SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed Feb. 18, 1901. The brakes on the rear trucks are set with less force than those on the forward trucks, to prevent skidding of the rear truck wheels due to the lifting of the car body from the rear truck when the brakes are applied.

729,744. SNAP SWITCH; Frank L. Fenn, Schenectady, N. Y. App. filed March 1, 1902. Details.

729,748. ALTERNATING CURRENT TRANSFORMER; John J. Frank, Schenectady, N. Y. App. filed Feb. 2, 1903. An arrangement of transformer coils such that connections may be made to three-wire systems of different voltages and the coils connected so as to give any one of a number of different voltages.

729,762. STARTING RHEOSTAT; Charles E. Harthan, Lynn, Mass. App. filed March 8, 1902. A thermostat in series with the line provides for a given interval of overload before opening the circuit breaker.



729,664.—Electric Motor.

729,771. ELECTRIC HEATER; Thomas J. Johnston, Schenectady, N. Y. App. filed Feb. 11, 1899. The heaters have coils of different capacities and by means of a suitable switch the heaters and coils can be connected in parallel or series to obtain various heating effects.

729,772. PUSH BUTTON SWITCH; Edwin G. Kasterhuber, Schenectady, N. Y. App. filed March 3, 1902. Details.

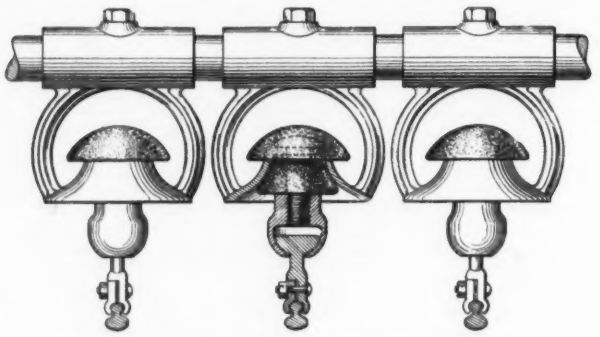
729,801. TELEPHONE-EXCHANGE SYSTEM; Charles B. Smith, New York, N. Y. App. filed June 25, 1901 (See page 1015.)

729,826. OVERHEAD STRUCTURE FOR ELECTRIC RAILWAYS; Ben Willard, New Orleans, La. App. filed Feb. 25, 1899. The ear that holds the wire is connected by a ball and socket joint with the insulator.

729,827. BATTERY; David H. Wilson, Chicago, Ill. App. filed April 30, 1902. The connection from the carbon cup leads from the bottom upward through the walls of the cell, so that creeping salts cannot reach the binding post.

729,828. LAMP RECEPTACLE; Herbert C. Wirt, Schenectady, N. Y. App. filed Dec. 19, 1900. A base having two grooves for the wires and a lamp socket attached thereto whose terminals extend into the groove, in combination with a cover.

729,833. SOLUTION FOR PRIMARY BATTERIES; Harry S. Amwake, Camden, N. J. App. filed May 22, 1900. A solution of sodium hydrate



729,826.—Overhead Structure for Electric Railways.

on one side of a partition and of sodium bichromate and sulphuric acid on the other side.

729,862. ELECTRIC HEATER; Joseph F. Hewitt and Charles W. Spatig, Allegheny, Pa. App. filed Dec. 30, 1901. A combined water tank and electric heater.

729,873. TYPEWRITING OR SIMILAR MACHINE AND APPARATUS FOR USE IN CONNECTION THEREWITH; Jules Lagarde, Clermont-Ferrand, France. App. filed July 27, 1901. Electro-magnets controlling the type bars are so arranged in connection with circuits and switching apparatus that the operator, by touching a given letter space on the keyboard, can cause either a small letter or a capital to be printed.

729,878. BRUSH HOLDER AND BRUSH FOR DYNAMO ELECTRIC MACHINES; Robert Lundell, New York, N. Y. App. filed Nov. 26, 1902. The brush holder contains a wedge-shaped central portion with brushes on the opposite sides of the same, which are pressed against the commutator and against the wedge portion at the same time.

729,879. FIELD MAGNET FOR DYNAMO ELECTRIC MACHINES OR ELECTRIC MOTORS; Robert Lundell, New York, N. Y. App. filed Dec. 26, 1902. The laminated yoke and pole pieces are supported upon the frame by devices which do not pass through the laminations.

729,882. ELECTRIC TRACTION; Auguste Megroz, Clarens, Switzerland. App. filed Nov. 25, 1902. A metallic conduit covered with suitable insulating material at all parts except an interior portion with which the current collector makes contact.

729,906. ELECTRIC LAMP; George Stein, New York, N. Y. App. filed Aug. 12, 1902. A lamp and holder for the use of physicians and dentists.

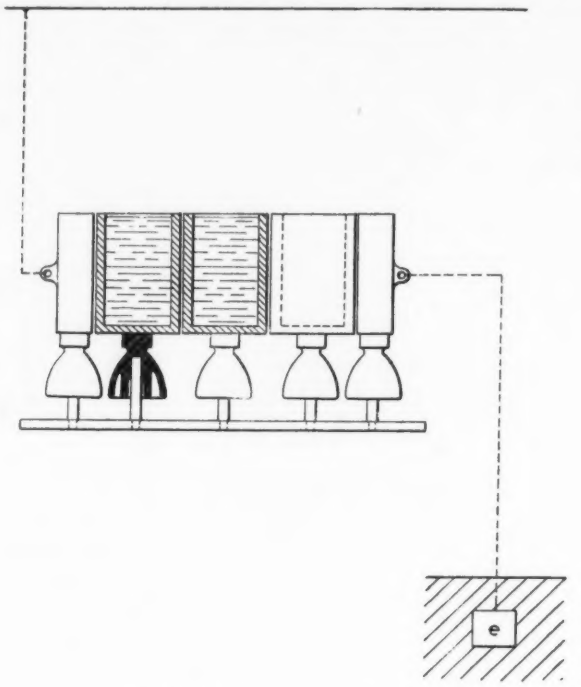
729,934. AUTOMATIC PARALLELLING DEVICE; Eli M. Hemphill, Avalon, and Edward Beiber, Pittsburg, Pa. App. filed Dec. 24, 1902. A solenoid is arranged in circuit with the "synchronizing lamps" to automatically throw the generators into parallel as soon as they are in synchronism.

729,952. ELECTRIC BURGLAR ALARM FOR VAULTS, SAFES, OR THE LIKE; Chas. O. Miller, Esterville, Iowa. App. filed March 29, 1902. Details.

729,957. TROLLEY; Miles McBride, Braddock, Pa. App. filed April 3, 1903. The pole carries two wheels, one on each side, and the spring gives it a downward tendency; it may therefore be lifted and reversed, one wheel being used for one direction of travel and the other for the opposite direction, the wheels making top contact.

730,014. PRIMARY BATTERY; James W. Gladstone, West Orange, N. J. App. filed Dec. 17, 1902. Details.

730,058. CONDUCTOR; George E. Tinker, New York, N. Y. App. filed Jan.



730,211.—Lightning Arrester for Electrical Plants.

9, 1903. A third-rail inclosed in a rectangular box having a narrow slot in the side for the arm of the collector.

730,061. REFLECTING GALVANOMETER; Edward Weston, Newark, N. J. App. filed July 9, 1902. The parts are secured to the lid of the case in such a manner that the axis of the magnetizable core, the movable coil and the support for the latter, are coincident when the instrument is levelled.

730,069. ELECTRIC LAMP; Alexander J. Wurts, Pittsburg, Pa. App. filed Sept. 28, 1901. Details of an automatic cut out for the heater of a Nernst lamp.

730,098. ELECTRIC SELF-PLAYING PIANO ATTACHMENT; George H. Davis, New York, N. Y. App. filed Dec. 23, 1898. Details.

7730,101. VOCAL GUARD FOR TELEPHONES; William J. Donihue, Jamestown, N. Y. App, filed June 9, 1902. (See page 1016.)

730,116. TROLLEY POLE; George W. Hamilton, Philadelphia, Pa. App. filed March 23, 1903. Two sets of arms pivoted together, two sets of links connected to the arms and a spring connecting the sets of links, the arrangement affording an extended movement of the arms with a limited amount of expansion and contraction of the springs.

730,181. ELECTRIC AUTOMATIC OVERFLOW ALARM; Robert J. Walker, Holland, Mich. App. filed May 21, 1902. Details of an apparatus involving contacts operated by a float.

730,186. CONDUIT AND SEWER ROD COUPLING; Albert W. Case, Brookline, Mass. App. filed May 31, 1902. Details.

730,211. LIGHTNING ARRESTER FOR ELECTRICAL PLANTS; Georg Honsberg, Nuremberg, Germany. App. filed Dec. 16, 1902. In the space between the electrodes are interposed vessels containing liquid and having porous walls slightly separated from each other.

730,216. ELECTRIC LAMP; Henry Noel Potter, Pittsburg, Pa. App. filed April 27, 1900. A Nernst lamp capable of operation in any position.